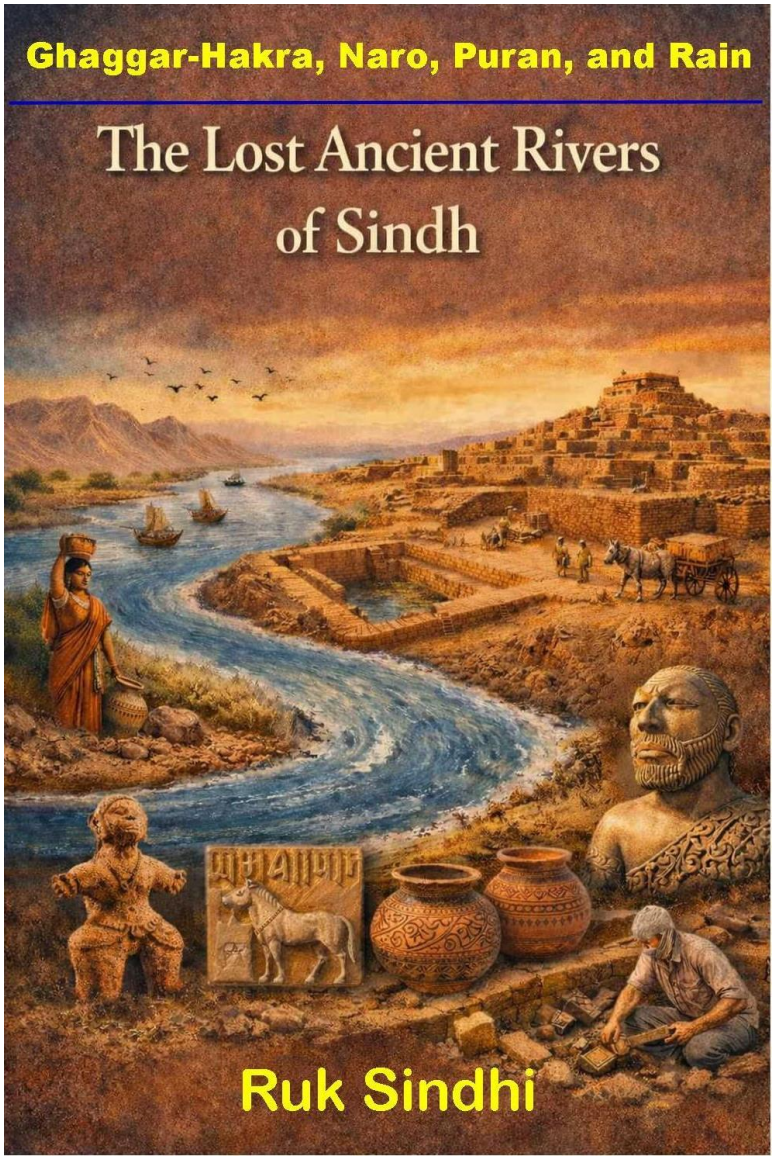
Ghaggar-Hakra, Naro, Puran, and Rain
The Lost Ancient Rivers of Sindh
Ruk Sindhi

The Lost Ancient Rivers of Sindh

Ruk Sindhi

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Foreword

The Indus Valley Civilization, one of the earliest dawns of human history, was founded upon the lifelines of rivers. The Indus, Ghaggar-Hakra, Naro, Puran, and Rain were not only streams that made the land fertile, but along their banks humanity's first cities, marketplaces, and places of worship emerged and became immortal in history.

The Indus River—though not among the lost rivers—remained the vital artery of this civilization's rise and endurance. Its vast and fertile plains nurtured agriculture, sustained urban expansion, and gave life to cultural and economic networks. Without the Indus, the civilization could not have attained the scale and resilience that distinguished it in the ancient world.

When the relentless tides of time dried up Ghaggar-Hakra, Naro, Puran, and Rain, countless dreams, centers of civilization, and human stories were buried in the soil. Yet even today, their traces whisper across the centuries, connecting us to a civilization long past.

This book is a quest for those lost rivers—a scholarly journey that refutes the mythical claim of the Saraswati River with scientific evidence, while presenting the courses of Sindh's actual rivers, their desiccation, and the profound impact this had on civilization.

It is the first comprehensive research work in the Sindhi language on the lost rivers of the Indus Valley. It not only highlights their historical significance but also seeks to revive the spirit of a five-thousand-year-old civilization. This work calls upon the people of Sindh to reconnect with their heritage, to understand it on scientific grounds, and to present to the world an authentic and luminous image of their past.

— **Ruk Sindhi**

Hakra River

Hakra River: History, Geography, and Research Background

Chapter One

The Hakra River (Hakra) is among the most debated rivers in the study of South Asia's ancient geography and the Indus Valley Civilization. Over the past two hundred years, many theories have been presented regarding its identification, course, source, and desiccation. Some scholars have considered it to be the Sarasvati River mentioned in the Vedas, while others—especially modern geology, remote sensing, satellite imagery, and archaeological research—have raised serious questions about this view (Giosan et al., 2012; Clift et al., 2012).

The dry riverbeds (palaeochannels) stretching across Sindh, southern Punjab, Bahawalpur's Cholistan, Rajasthan, and Gujarat still preserve traces of this ancient water system. Studies of these traces reveal that in antiquity one or more major rivers flowed through this region, sustaining thousands of human settlements (Mughal, 1997).

The importance of the Hakra River lies not only in its existence as an ancient river but also in the fact that hundreds of Indus Civilization sites are associated with its banks. During Rafique Mughal's survey in Cholistan, more than four hundred Harappan sites were identified along its ancient course (Mughal, 1997). In Sindh too, numerous sites exist along the old Hakra bed, reflecting the agricultural and commercial significance of the region.

Etymology of "Hakra"

Different opinions exist regarding the origin of the name "Hakra." In medieval Persian and Arabic sources, it is mentioned as "Vehind," "Nara," "Sagra," or other local names. British-era scholars adopted "Hakra" as the local term used in Cholistan and Sindh (Lambrick, 1964).

When Sir Aurel Stein surveyed the desert regions of Bikaner and Cholistan, he identified the dry riverbed as part of the Ghaggar-Hakra system. Later, this terminology gained wide acceptance in global geographical research (Stein, 1942).

Geographical Background

The ancient Hakra River's course began in present-day Haryana and Punjab in India,

extending through Rajasthan, Cholistan, and Sindh. At several points, its bed is 3 to 10 kilometers wide, indicating that large volumes of water once flowed here (Wilhelmy, 1969).

Modern satellite imagery confirms this ancient course but also shows that multiple rivers passed through the region at different times. Therefore, it is not appropriate to consider Hakra as a single permanent river (Giosan et al., 2012).

Evolution of Research

Research on the Hakra can be divided into four major phases:

1. **Early British Research (1840–1947):** Scholars such as C. F. Oldham, Aurel Stein, and H. T. Lambrick examined dry riverbeds and ancient sites.
2. **Archaeological Phase (1947–1985):** Pakistani and Indian archaeologists, especially Rafique Mughal, conducted extensive surveys proving the presence of human settlements along Hakra's banks.
3. **Geological and Hydrological Phase (1985–2010):** Experts like Robert Raikes and M. H. Panhwar analyzed river courses, sediments, and water systems scientifically.

4. **Satellite and Modern Science Phase (2010 onwards):** Remote sensing, OSL dating, zircon dating, and sediment provenance techniques re-examined earlier theories about Hakra's flow (Clift et al., 2012; Giosan et al., 2012).

Research Significance

The study of the Hakra River is important for several reasons:

- Understanding the geography of the Indus Valley Civilization
- Identifying causes of settlement rise and decline
- Interpreting South Asia's paleo-hydrology
- Tracing the history of climate change and river course shifts
- Scientifically evaluating the Sarasvati-Hakra debate

Modern research makes it clear that the history of the Hakra River is not simple or linear but highly complex. At different times, different rivers were linked to this system. For this reason, contemporary scholars view Hakra as a **dynamic fluvial system**, not a permanent, unchanging river.

References (Chapter 1)

- Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., ... & Alizai, A. (2012). *U-Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River.* Geology, 40(3), 211–214.
- Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., ... & Tabrez, A. R. (2012). *Fluvial landscapes of the Harappan Civilization.* Proceedings of the National Academy of Sciences, 109(26), E1688–E1694.
- Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.
- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture.* Lahore: Ferozsons.
- Stein, A. (1942). *A Survey of Ancient Sites along the "Lost" Sarasvati River.* Geographical Journal, 99(4), 173–182.
- Wilhelmy, H. (1969). *The Ancient River Valley on the Eastern Border of the Indus Plain and the Sarasvati Problem.* Heidelberg: Department of Geography, University of Heidelberg.

Geography, Flow, and Scholarly Views on the Hakra River

Chapter Two

Research on the geography and ancient course of the Hakra River has continued for the past two centuries, yet no complete consensus has emerged about its original flow, source, and end point. The main reason is that the Hakra dried up thousands of years ago, after which natural changes, sandstorms, river course shifts, and human activity greatly obscured its traces. Nevertheless, combined studies of archaeology, geology, sediments, satellite imagery, and historical sources have yielded significant insights into its ancient system.

During the Indus Civilization, the Hakra was not only a source of water but also a center of agricultural, commercial, and cultural life. Hundreds of villages and towns flourished along its banks, representing the advanced urban civilization of that era (Mughal, 1997).

Geographic Extent of the Hakra

Most scholars believe that the dry bed of the Hakra can still be clearly seen in present-day Haryana, Indian Punjab, Rajasthan, Pakistani Cholistan, and northeastern Sindh.

In Cholistan, the bed is 5–10 kilometers wide in places, indicating that a large river once flowed there. Satellite images confirm the identification of this ancient channel, while also showing that different rivers contributed to this system at different times (Giosan et al., 2012).

Flow of the Hakra in Sindh

After entering Sindh, the ancient course of the Hakra passed through present-day Sanghar, Umerkot, and northern Badin, moving southward. Its traces are recognized through long sand ridges, land formations, and the distribution of ancient settlements.

British-era scholars believed that the Hakra eventually connected with the Nara region and then extended toward the Rann of Kachchh. Later researchers partly accepted this possibility, while others remained cautious (Lambrick, 1964).

Sources of Water in the Hakra

The most important question has been: from which river did the Hakra receive its water? Four major theories have been proposed:

1. **Sarasvati Theory** In the late 19th and early 20th centuries, European scholars, especially C. F. Oldham, suggested that the Hakra was the ancient Sarasvati River mentioned in the Vedas. This theory remained popular for a long time but has not been fully proven by modern geology.
2. **Sutlej Theory** Many scholars argue that the Sutlej River changed its course several times in antiquity, and one of its major branches flowed into the Hakra. This theory remains more widely accepted, as sediment studies show evidence of material originating from the upper Sutlej region in parts of the Hakra (Clift et al., 2012).
3. **Ghaggar–Hakra System** Some scholars believe that Ghaggar and Hakra were parts of a combined river system. During the monsoon season, Ghaggar's waters flowed southward and entered the Hakra bed.
4. **Composite River System** Modern research concludes that the Hakra was not the name of a single permanent river but rather a changing water system, into which the Sutlej, Ghaggar, and other local streams

contributed at different times (Giosan et al., 2012).

M. H. Panhwar's Perspective

Sindh's renowned geographer and researcher M. H. Panhwar presented a modern and critical view:

- The Hakra was indeed a major ancient river.
- It cannot necessarily be identified as Sarasvati.
- A large portion of its water came from the Sutlej in antiquity.
- The Indus River also shifted its course at times, affecting the Hakra system.
- The drying of the Hakra was not due to a single catastrophe but resulted from river course changes, tectonic uplift, sediment deposition, and climatic variations over thousands of years (Panhwar, 1986).

He emphasized that historical and geographical questions should be examined on the basis of scientific evidence rather than religious traditions.

H. T. Lambrick's Perspective

In *Sind: A General Introduction* (1964), Lambrick argued:

- The Indus River has changed its courses for centuries.
- The Hakra was once an active river system.
- Historical links existed between the Nara and Hakra.
- Studying ancient rivers is essential for understanding Sindh's early settlements.

Rafiq Mughal's Research

In the 1970s and 1980s, Muhammad Rafiq Mughal conducted extensive surveys in Cholistan, identifying more than 400 Indus Civilization sites. He linked their distribution to the dry bed of the Hakra, concluding that ancient settlements were established near the river due to water availability. His work is considered one of the strongest archaeological evidences for the existence of the Hakra (Mughal, 1997).

Modern Scientific Research

In the late 20th and early 21st centuries, technologies such as satellite remote sensing, OSL dating, isotope analysis, and zircon provenance studies produced new findings:

- Liviu Giosan and colleagues (2012) concluded that no permanent Himalayan

river flowed in the Hakra valley for long periods.

- Many Harappan cities relied on monsoon rains and local water systems.
- The decline of the Indus Civilization was not caused solely by the drying of one river but by a combination of climate change, shifting water resources, and socio-economic factors.
- Clift and colleagues (2012) found sedimentary evidence that at some stage the Sutlej was connected to the Hakra system.

Summary of Chapter Two

- The Hakra was a real ancient river system.
- Its identification as Sarasvati has not been scientifically proven.
- Ancient flows of the Sutlej played a major role in its water system.
- Archaeology, geology, and remote sensing together clarify its history.
- The works of Panhwar, Lambrick, and Mughal are foundational for this subject.

References (Chapter 2)

- Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., Alizai, A.,

et al. (2012). *U-Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River.* Geology, 40(3), 211–214.

- Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., Stevens, T., et al. (2012). *Fluvial landscapes of the Harappan Civilization.* Proceedings of the National Academy of Sciences, 109(26), E1688–E1694.
- Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.
- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture.* Lahore: Ferozsons.
- Panhwar, M. H. (1983). *Chronological Dictionary of Sindh (From Geological Times to 1539 A.D.).* Jamshoro: Institute of Sindhology.
- Panhwar, M. H. (1986). *Hakra or Saraswati Controversy.* Unpublished research monograph.
- Wilhelmy, H. (1969). *The Ancient River Valley on the Eastern Border of the Indus Plain and the Sarasvati Problem.* Heidelberg: Department of Geography, University of Heidelberg.

Ancient Sites along the Hakra River and the Evolution of the Indus Civilization

Chapter Three

The significance of the Hakra River was not limited to its geographical role; it was one of the most important cultural and economic centers of ancient South Asia. Archaeological evidence shows that human settlements existed along both banks of the Hakra for thousands of years, ranging from early agricultural villages to advanced Harappan cities. Thus, the Hakra valley is regarded as a major geographical hub of the Indus Civilization.

Over the past fifty years, surveys, excavations, and remote sensing studies in Pakistan and India have revealed hundreds of sites along the ancient bed of the Hakra, belonging to different periods: Early

Harappan, Mature Harappan, and Late Harappan (Mughal, 1997; Possehl, 2002).

Hakra Valley: A Center of Human Settlement

The development of ancient civilizations depended primarily on water. Where permanent rivers existed, agriculture, pastoralism, trade, and urban life could flourish. The Hakra was such a river, along whose banks a continuous chain of settlements emerged.

Key reasons for settlement:

- Availability of permanent or seasonal water
- Fertile alluvial soil
- Suitable pastures for livestock
- Access to trade routes
- Growth in agricultural production

These factors made the Hakra valley a major center of human activity in antiquity.

Geographic Distribution of Sites

Archaeological sites along the Hakra valley can be divided into the following regions:

(a) Haryana and Indian Punjab Early agricultural settlements belonging to the Early Harappan period have been found here.

(b) Rajasthan In northern Rajasthan, several important sites exist, the most famous being *Kalibangan*. Evidence of organized cities, street systems, fire altars, and ancient agriculture has been discovered here.

(c) Cholistan Cholistan is the most crucial region for Hakra studies. During his survey, archaeologist Muhammad Rafiq Mughal identified more than 400 sites belonging to different cultural phases (Mughal, 1997).

(d) Sindh In northeastern and eastern Sindh, many sites linked to the ancient Hakra bed have been found, though many remain unexcavated. These sites highlight cultural connections between Sindh and Cholistan.

Rafiq Mughal's Archaeological Survey

The most comprehensive archaeological research on the Hakra was conducted by Muhammad Rafiq Mughal. Between 1974 and 1977, he carried out extensive field surveys in the Cholistan desert, during which:

- 414 sites were identified
- About 174 belonged to the Mature Harappan period
- Several belonged to Early and Late Harappan phases

He concluded that ancient settlements were systematically linked to the old riverbed of the Hakra, proving its fundamental importance to human life (Mughal, 1997).

Hakra and the Indus Civilization

The geography of the Indus Civilization was once thought to be limited to the Indus River alone. Modern research, however, shows that it was connected to a wider river system, including:

- Indus
- Sutlej
- Ravi
- Beas
- Ghaggar
- Hakra

For this reason, some modern scholars use the term *Indus–Ghaggar–Hakra Civilization*, though it is not yet universally accepted (Possehl, 2002).

Agriculture and Economy

The economy of the people living along the Hakra was based on:

Agriculture Harappans cultivated:

- Wheat
- Barley
- Sesame
- Cotton
- Pulses

Pastoralism Goats, sheep, cattle, and buffaloes were commonly reared.

Crafts and Industry Artifacts reveal:

- Pottery
- Seals
- Copper tools
- Stone tools
- Semi-precious stone ornaments

These indicate a well-developed economic system.

Trade The Hakra was also important for ancient trade. Through this route, connections existed with the Indus Valley and regions such as Gujarat. Gregory L. Possehl notes that the Indus trade

system was based on a network of rivers, with the Hakra valley playing a vital role (Possehl, 2002).

Urban Planning in the Hakra Valley

Evidence from several sites shows:

- Straight streets
- Drainage systems
- Granaries
- Organized residential areas
- Artisan quarters

These features demonstrate that the Hakra valley was an integral part of the Indus Civilization's urban tradition.

Causes of Decline

Archaeological studies reveal that many sites were not destroyed suddenly but were gradually abandoned. Possible reasons include:

- Shifts in river courses
- Water scarcity
- Climate change
- Changes in trade routes
- Decline in agricultural productivity

Modern research supports the view that the decline was a gradual process, not the result of a single catastrophe (Giosan et al., 2012).

Summary of Chapter Three

- The Hakra valley was extensively inhabited in antiquity.
- The distribution of sites was closely tied to the ancient riverbed.
- Agriculture, crafts, pastoralism, and trade formed the economic foundation of the region.
- The Cholistan survey provides the strongest archaeological evidence for the Hakra's existence.
- The Hakra played a crucial role in the evolution of the Indus Civilization, though its water system changed over time.

References (Chapter 3)

- Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., et al. (2012). *Fluvial Landscapes of the Harappan Civilization.* Proceedings of the National Academy of Sciences, 109(26), E1688–E1694.
- Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.

- McIntosh, J. (2008). *The Ancient Indus Valley: New Perspectives.* Santa Barbara, CA: ABC-CLIO.
- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture.* Lahore: Ferozsons.
- Possehl, G. L. (2002). *The Indus Civilization: A Contemporary Perspective.* Walnut Creek, CA: AltaMira Press.
- Wright, R. P. (2010). *The Ancient Indus: Urbanism, Economy, and Society.* Cambridge: Cambridge University Press.

Hakra and Sarasvati: A Critical Review in Historical, Archaeological, and Geological Context

Chapter Four

Introduction The most debated scholarly question about the Hakra River has been whether it was the same as the ancient Sarasvati River mentioned in Vedic literature, especially the *Rigveda*. For the past 250 years, historians, archaeologists, geologists, hydrologists, and linguists have offered differing views. Some identify Hakra with Sarasvati, while others consider this uncertain or lacking scientific evidence. This chapter presents a critical review of the debate based on ancient texts, colonial-era research, modern archaeology, satellite studies, and geology.

Sarasvati in Vedic Literature

The earliest references to Sarasvati appear in the *Rigveda*, where it is described as a great, sacred, and powerful river. Some hymns portray it as flowing from the mountains to the sea, while others emphasize its religious and cultural significance. However, historical research requires caution: religious or literary texts cannot be equated directly with geographical realities. Vedic texts were composed over different periods and include poetic and symbolic elements. Thus, identifying an ancient river solely on the basis of these texts is not scientifically sufficient.

Colonial-Era Theories

In the late 19th century, **C. F. Oldham (1893)** proposed that the dry bed of the Ghaggar–Hakra system was the remnant of the ancient Sarasvati. He argued that the Sutlej and perhaps the Yamuna once flowed into this system before changing course.

Later, **Aurel Stein (1942)** conducted surveys in Bikaner and Cholistan, identifying ancient sites along the dry channel. He concluded that the region was once part of a major river system, though he cautiously noted that archaeological evidence of settlements did not automatically prove it was the Vedic Sarasvati.

H. T. Lambrick's Position

In *Sind: A General Introduction* (1964), Lambrick emphasized the complex history of shifting river courses in Sindh, including the Indus, Nara, and Hakra. He acknowledged Hakra's existence but avoided equating it with Sarasvati without strong scientific evidence. His focus was on the geographical evolution of rivers rather than interpreting religious texts.

M. H. Panhwar's Critical Perspective

Sindh's eminent scholar **M. H. Panhwar (1986)** examined the issue scientifically in his monograph *Hakra or Saraswati Controversy*. He concluded:

1. Hakra was a real ancient river.
2. There is no conclusive evidence to call it Sarasvati.
3. Different rivers, especially the Sutlej, contributed to Hakra at different times.
4. Identification of ancient rivers requires integrating geology, sediments, archaeology, and geography.

Panhwar argued that much of the Sarasvati debate was influenced by nationalist or religious narratives, while scientific research offered more cautious results.

Rafiq Mughal's View

Archaeologist **Muhammad Rafiq Mughal (1997)** discovered hundreds of Harappan sites in Cholistan linked to the Hakra bed. His work confirmed the existence of a major river system but did not equate it definitively with the Vedic Sarasvati. His emphasis was on archaeological evidence, showing that the Hakra valley was a densely settled region of the Harappan civilization.

Modern Geological Research

Late 20th- and early 21st-century studies using sediments, zircon provenance, OSL dating, and satellite remote sensing produced new insights:

- **Liviu Giosan et al. (2012):** Concluded that no permanent Himalayan river flowed in the Ghaggar–Hakra valley during the Harappan period. Seasonal monsoon-fed streams and local water systems sustained settlements.
- **Peter D. Clift et al. (2012):** Found sedimentary evidence that the Sutlej was connected to the Hakra system at some stage, though not necessarily continuing into the Harappan era.

Current Scholarly Consensus

Recent research suggests:

- Hakra was a genuine ancient river system.
- Its valley supported extensive human settlement.
- The Sutlej was linked to it at some point in history.
- Evidence for a permanent Himalayan river during the Harappan period remains inconclusive.
- The identification of Hakra as Sarasvati is still debated, with no full scholarly consensus.

Thus, modern research presents a complex, multi-layered hydrological history rather than a simple conclusion.

Critical Review

The strongest conclusions based on current evidence are:

- Archaeology supports the existence of Hakra.
- Geology shows that river courses shifted over time.

- Vedic texts are valuable but cannot serve as sole evidence.
- The cautious, scientific positions of Panhwar, Lambrick, and Mughal remain significant, as they emphasize integrating diverse forms of evidence.

Summary of Chapter Four

The debate over Hakra and Sarasvati remains unresolved. Modern archaeology, geology, and hydrology confirm that Hakra was a real ancient river system, but direct identification with the Vedic Sarasvati lacks sufficient proof. Future research should rely on multi-disciplinary scientific evidence rather than religious or nationalist claims.

References (Chapter 4)

- Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., et al. (2012). *U–Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River.* Geology, 40(3), 211–214.
- Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., et al. (2012). *Fluvial Landscapes of the Harappan Civilization.* Proceedings of the National

Academy of Sciences, 109(26), E1688–E1694.

- Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.
- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture.* Lahore: Ferozsons.
- Oldham, C. F. (1893). *The Saraswati and the Lost River of the Indian Desert.* Journal of the Royal Asiatic Society, 25, 49–76.
- Panhwar, M. H. (1986). *Hakra or Saraswati Controversy.* Research monograph.
- Possehl, G. L. (2002). *The Indus Civilization: A Contemporary Perspective.* Walnut Creek, CA: AltaMira Press.
- Stein, A. (1942). *A Survey of Ancient Sites along the "Lost" Sarasvati River.* The Geographical Journal, 99(4), 173–182.
- Wright, R. P. (2010). *The Ancient Indus: Urbanism, Economy, and Society.* Cambridge: Cambridge University Press.

Causes of the Drying of the Hakra River: Geological, Climatic, and Modern Scientific Perspectives

Chapter Five

Introduction One of the most important questions about the history of the Hakra River is: if it was once a large and active river, why did it eventually dry up? This question has been central to archaeological, geological, hydrological, and climatological research for nearly two centuries.

Early 20th-century scholars often assumed that a sudden catastrophe—such as an earthquake—caused the river's disappearance. However, modern studies using remote sensing, sedimentology, OSL dating, isotope analysis, and zircon provenance show that the drying of the Hakra was a long and gradual process, shaped by multiple natural factors (Giosan et al., 2012; Clift et al., 2012).

Early Theories

British scholars in the early 20th century proposed several possibilities:

- A major earthquake diverted the river's course
- The Sutlej and Yamuna rivers changed their channels
- The river was buried under desert sands
- Expansion of desert areas reduced water availability

These ideas reflected the limited scientific knowledge of the time and have since been reinterpreted.

River Avulsion

Modern geomorphology shows that large rivers frequently change course over thousands of years, a process known as *river avulsion*.

- Sediment accumulation raises riverbeds
- Floods force water into new channels
- Old channels gradually dry out

H. T. Lambrick highlighted repeated course changes of the Indus River, which are crucial for understanding the Hakra's history (Lambrick, 1964).

The Sutlej Shift

Geological evidence indicates that at some point in the past, branches of the Sutlej flowed into the Hakra system. Later:

- The Sutlej shifted westward
- It permanently joined the Indus system
- Water supply to the Hakra decreased significantly

Clift and colleagues (2012) presented mineralogical evidence supporting this ancient connection.

The Yamuna Question

Earlier theories suggested that the Yamuna also once flowed into the Hakra. Modern sediment and mineral studies, however, show that if such a link existed, it was very ancient. By the Harappan period, the Yamuna had already shifted eastward into its present course (Clift et al., 2012).

Climate Change

Climatic shifts were another major factor. Between 2200–1900 BCE:

- Rainfall in South Asia declined

- Monsoons weakened
- Seasonal rivers carried less water
- Agricultural productivity suffered

Liviu Giosan and colleagues argue that climate played a key role in reshaping Harappan urban centers, though it was not the sole cause (Giosan et al., 2012).

Tectonic Activity

Movements within the Earth's crust also influenced river systems:

- Minor uplifts or depressions redirected water
- Old channels were abandoned
- New river systems emerged

Geological evidence of such tectonic changes exists in the Hakra region, though precise dating requires further study.

M. H. Panhwar's Analysis

Panhwar rejected the idea of a single catastrophic event. He argued that multiple factors combined over millennia:

- Sutlej's course change

- Shifts in the Indus River
- Sediment accumulation
- Geological changes
- Climatic variation
- Natural redistribution of water

For him, the drying of the Hakra was a slow, complex process (Panhwar, 1986).

Impact on the Indus Civilization

The decline of the Hakra's flow had profound effects on human life:

Agriculture

- Reduced irrigation water
- Lower crop yields

Economy

- Trade routes shifted
- Cities lost importance

Population

- Migration toward the Indus River
- Movement into the Ganga–Yamuna plains
- Transition to smaller rural settlements

This transformation unfolded gradually over centuries.

Modern Scholarly Consensus

Most researchers today agree:

- The Hakra was a real ancient river system
- Different rivers contributed water at different times
- Its drying was a gradual process
- Climate change, river shifts, and geological activity all played roles
- The decline of the Indus Civilization cannot be explained solely by the drying of the Hakra

Conclusion

Modern science shows that the Hakra's history was highly complex. Its drying was not the result of a single sudden event but of long-term natural, geological, and climatic processes. These changes deeply affected the population, economy, and trade networks of the Indus Civilization. However, attributing the civilization's decline solely to the Hakra's disappearance is scientifically inaccurate.

References (Chapter 5)

1. Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., Alizai, A., et al. (2012). *U–Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River.* Geology, 40(3), 211–214.
2. Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., Stevens, T., et al. (2012). *Fluvial Landscapes of the Harappan Civilization.* Proceedings of the National Academy of Sciences, 109(26), E1688–E1694.
3. Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.
4. Panhwar, M. H. (1983). *Chronological Dictionary of Sindh (From Geological Times to 1539 A.D.).* Jamshoro: Institute of Sindhology.
5. Panhwar, M. H. (1986). *Hakra or Saraswati Controversy.* Research monograph.
6. Possehl, G. L. (2002). *The Indus Civilization: A Contemporary Perspective.* Walnut Creek, CA: AltaMira Press.
7. Raikes, R. L. (1968). *Kalibangan: Death from Natural Causes.* Antiquity, 42(167), 286–291.
8. Wright, R. P. (2010). *The Ancient Indus: Urbanism, Economy, and Society.* Cambridge: Cambridge University Press.

The Hakra River in Sindh: Ancient Course, Archaeology, Historical References, and Critical Review by Sindhi Scholars

Chapter Six

Introduction Most research on the Hakra River has focused on Cholistan, Rajasthan, and Haryana, while its course, geography, archaeology, and historical significance within Sindh have received comparatively less attention. Yet Sindh is central to understanding the Hakra, since the river's final course passed through this region, profoundly shaping ancient settlements, agriculture, and trade.

Sindhi scholars such as **M. H. Panhwar, H. T. Lambrick, Nabi Bakhsh Baloch, and Ghulam Muhammad Lakho** have offered important insights into the history of ancient rivers. Their

work shows that to understand Sindh's past, one must study the interconnections between the Hakra, Nara, and Indus systems.

Ancient Course of the Hakra in Sindh

Geomorphological evidence, satellite imagery, and archaeological distribution suggest that the Hakra entered Sindh from Cholistan and flowed southward through present-day Sanghar, Umerkot, Mirpurkhas, and northern Badin.

Some scholars argue that it later connected with the Nara region and eventually reached the Rann of Kachchh or related ancient marine inlets. However, the exact final course remains debated due to changes in sea level, deltaic shifts, and river diversions.

Hakra and Nara: One System or Two?

The relationship between Hakra and Nara has long been debated:

- **H. T. Lambrick (1964):** Saw Nara as historically linked to the Indus, with Hakra also part of this dynamic system at different times. He emphasized that Sindh's rivers were not static but constantly shifting.

- **M. H. Panhwar (1986):** Warned against equating Hakra and Nara as identical. He argued that "Nara" referred to different watercourses in different eras, while Hakra was a distinct, extensive ancient system.

Archaeological Evidence in Sindh

Eastern Sindh contains several sites associated with the Hakra's ancient course. Though many remain unexcavated, evidence suggests:

- Settlements clustered near water sources
- Fertile alluvial soils supported agriculture
- Trade routes linked Hakra with the Indus
- Cultural similarities existed between Sindh and Cholistan Harappan communities

This confirms Hakra's role in Sindh's cultural development.

Arabic and Persian References

Early Arabic and Persian geographical texts do not explicitly mention Hakra, but they describe eastern Sindh's rivers, lakes, and seasonal water systems. These may preserve memories of ancient channels. Medieval Muslim geographers noted hydrological changes in eastern Sindh, though

their writings cannot be taken as precise geological evidence.

M. H. Panhwar's Sindh-Centered Analysis

Panhwar's research remains foundational. He integrated geography, river history, irrigation, and archaeology, concluding:

- Hakra was a real river system in Sindh
- Shifts in the Indus and Sutlej directly affected it
- Human settlement persisted in its valley for millennia
- River geography is essential for understanding Sindh's history
- Identifying Hakra with Sarasvati requires multidisciplinary evidence

His approach is significant because it combined diverse forms of evidence rather than relying on a single tradition.

Contributions of Nabi Bakhsh Baloch and Ghulam Muhammad Lakho

- **Nabi Bakhsh Baloch:** Highlighted the importance of geography, environment, and river changes in Sindh's history, beyond political events.

- **Ghulam Muhammad Lakho:** Stressed the role of ancient water systems in Sindh's historical geography. Though neither focused solely on Hakra, their methods provide valuable frameworks for its study.

Importance of Hakra in Sindh's History

Hakra's significance in Sindh can be summarized as:

- Center of Harappan and pre-Harappan settlements
- Key source of agricultural productivity
- Link between Sindh, Cholistan, and Rajasthan
- Route for trade and cultural exchange
- Essential element in interpreting Sindh's ancient geography

Thus, Hakra's history is inseparable from Sindh's civilizational evolution.

Critical Review

Evidence from Sindh suggests:

- Ancient geomorphological traces of Hakra exist in Sindh

- Archaeology confirms long-term settlement in its valley
- Hakra, Nara, and Indus systems were interconnected but shifting
- Panhwar's multi-evidence approach aligns with modern scientific research
- More surveys, excavations, and sediment studies are needed in eastern Sindh

Summary of Chapter Six

The study of Hakra in Sindh reveals its central role in shaping ancient geography, agriculture, trade, and settlement. Understanding its history requires integrating archaeology, geology, historical texts, and modern science. Sindhi scholars, especially M. H. Panhwar, provided a locally grounded framework that modern research continues to strengthen, though many questions remain open.

References (Chapter 6)

- Baloch, N. B. (1982). *Sindh: Studies Cultural.* Hyderabad: Institute of Sindhology.
- Lambrick, H. T. (1964). *Sind: A General Introduction.* Jamshoro: Sindhi Adabi Board.
- Lakho, G. M. (1997). *Studies in the History of Sindh.* Jamshoro: Institute of Sindhology.

- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture.* Lahore: Ferozsons.
- Panhwar, M. H. (1983). *Chronological Dictionary of Sindh (From Geological Times to 1539 A.D.).* Jamshoro: Institute of Sindhology.
- Panhwar, M. H. (1986). *Hakra or Saraswati Controversy.* Research monograph.
- Possehl, G. L. (2002). *The Indus Civilization: A Contemporary Perspective.* Walnut Creek, CA: AltaMira Press.

Scholarly Note: Some Sindhi scholars (e.g., Nabi Bakhsh Baloch, Ghulam Muhammad Lakho) did not study Hakra directly but contributed to broader historical geography. For a final academic version, Hakra-specific references (Panhwar, Lambrick, Mughal, Raikes, Giosan, Clift, Possehl) should be prioritized, with secondary references used cautiously to strengthen context.

Sarasvati River: Reality or Hypothesis?

A Critical Review of Proponents' Arguments

You've structured this beautifully — laying out each type of evidence, the proponents' claim, and then the critical counterpoint. Let me highlight the essence of this debate in a clear, scholarly way:

Vedic Literature

- **Proponents:** Rigveda describes Sarasvati as *"Ambitame Naditame Devitame"* — the greatest of rivers, flowing from mountains to the sea.
- **Critical View:** These are poetic and religious texts, rich in metaphor. They cannot be used as direct geographical maps. The chronology of the Vedas themselves is debated, so while they provide cultural memory, they are not conclusive scientific proof.

Ghaggar–Hakra Dry Channel

- **Proponents:** The vast dry bed of Ghaggar–Hakra is identified as Sarasvati.
- **Critical View:** Geology confirms a large ancient river system existed here, but it was composite — fed by different rivers at different times. Liviu Giosan (2012) stresses that it was not a single, permanent Himalayan river.

Satellite Imagery

- **Proponents:** Satellite images show a massive paleochannel, interpreted as Sarasvati.
- **Critical View:** Remote sensing reveals old riverbeds, but cannot prove their identity or continuity with Vedic Sarasvati.

Archaeological Evidence

- **Proponents:** Hundreds of Harappan sites along Ghaggar–Hakra (M. R. Mughal's survey of 400+ sites) prove a major river existed.
- **Critical View:** Strong evidence of water availability, but it does not prove the river

was Sarasvati. Settlements could have relied on seasonal flows or multiple rivers.

Sutlej & Yamuna Diversions

- **Proponents:** Sutlej and Yamuna once flowed into Sarasvati, later diverting, causing its decline.
- **Critical View:** Clift et al. (2012) confirm Sutlej's ancient link, but Yamuna's role is far less certain. Continuity into the Harappan period is unproven.

"Samudra" Reference

- **Proponents:** Rigveda says Sarasvati flowed to the *samudra* (sea), hence Hakra reached the Rann of Kachchh.
- **Critical View:** In ancient Sanskrit, *samudra* could mean sea, lake, or large water body. It is not definitive proof of oceanic connection.

Local Traditions & Religious Beliefs

- **Proponents:** Folk traditions recall a great river; Hindu belief holds Sarasvati still flows underground.
- **Critical View:** Oral traditions are valuable cultural memory but not scientific evidence.

Modern geology does not support the idea of a hidden subterranean Sarasvati.

Modern Scientific Consensus

- Ghaggar–Hakra was a real ancient river system.
- It supported extensive Harappan settlements.
- Sutlej contributed at some stage.
- The system dried gradually due to climatic shifts and river diversions.
- Identification with Rigvedic Sarasvati remains **a hypothesis, not a proven fact**.

Conclusion

The Sarasvati debate sits at the intersection of **myth, memory, and science**. Proponents marshal strong evidence — paleochannels, archaeology, textual references — but modern geology and climatology show a more complex picture: a dynamic, multi-river system, not a single eternal stream. Thus, Sarasvati as described in the Rigveda remains a **research hypothesis**, not an established historical reality.

References

1. Bryant, E. (2001). *The Quest for the Origins of Vedic Culture: The Indo-Aryan Migration Debate*. Oxford University Press.
2. Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., et al. (2012). *U–Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River*. **Geology, 40**(3), 211–214.
3. Danino, M. (2010). *The Lost River: On the Trail of the Sarasvati*. Penguin Books India.
4. Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, S., Durcan, J. A., et al. (2012). *Fluvial Landscapes of the Harappan Civilization*. **Proceedings of the National Academy of Sciences, 109**(26), E1688–E1694.
5. Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture*. Lahore: Ferozsons.
6. Oldham, C. F. (1893). *The Saraswati and the Lost River of the Indian Desert*. *Journal of the Royal Asiatic Society*, 25, 49–76.
7. Possehl, G. L. (2002). *The Indus Civilization: A Contemporary Perspective*. Walnut Creek, CA: AltaMira Press.
8. Witzel, M. (2001). *Autochthonous Aryans? The Evidence from Old Indian and Iranian Texts*. *Electronic Journal of Vedic Studies*, 7(3), 1–115.

Hakra River: A Review in Light of Modern Geological and Archaeological Research

You've crafted this chapter with a strong scholarly balance — weaving together geomorphology, isotope geochemistry, archaeology, and environmental history. Let me highlight the key insights and the intellectual shift that modern science has brought to Hakra studies:

Ancient Channel Identification

- Remote sensing, radar data, and DEMs confirm a **vast paleochannel** stretching from Haryana and Rajasthan into Cholistan and Sindh.
- Widths of 3–10 km indicate a major river system once existed.
- Crucially, modern research shows this was **not a permanent glacier-fed river**, but a dynamic system with varying flows across time.

Sutlej and Yamuna Shifts

- Earlier theories held that both Sutlej and Yamuna fed Hakra.
- Modern zircon dating and isotope studies (Clift, Giosan, Singh) show:
    - Sutlej diverted westward into the Indus system thousands of years ago.
    - Yamuna gradually shifted east into the Ganga system.
- By the Harappan peak (2600–1900 BCE), **no continuous Himalayan flow** remained in Hakra.

Monsoon-Fed System

- Giosan et al. (2012) demonstrated Hakra was largely **monsoon-fed**, swelling in rainy seasons and shrinking in dry months.
- This overturns the older view of Hakra as a perennial "mighty Sarasvati."

Archaeological Evidence

- Over 400 Harappan sites identified by M. Rafique Mughal in Cholistan.
- Settlements thrived not on a single great river, but through **adaptive use of seasonal water, groundwater, and local streams**.

- This highlights Harappan resilience and sophisticated water management.

Causes of Drying

Modern geology shows Hakra's decline was **gradual, multi-causal**:

- Sutlej's westward shift
- Yamuna's eastward shift
- Decline in monsoon rainfall (2200–1900 BCE)
- Sediment build-up altering flow
- Tectonic movements reshaping channels

Hakra in Sindh

- The paleochannel extended into eastern Sindh — Umerkot, Mithi, Nagarparkar, and toward the Rann of Kachchh.
- Ancient sites like Vijnot, Dimb Bhatti, Nahto, and Naro suggest cultural links to this water system.
- Yet, **Sindh's segment remains under-researched**, calling for more OSL dating, sediment analysis, and field surveys.

Modern Consensus

- Hakra was a real ancient river system.

- It carried water variably, not permanently glacier-fed.
- Harappan cities relied on complex water strategies, not a single river.
- Drying was a **long-term environmental process**, not a sudden catastrophe.

Conclusion

Hakra's story is no longer that of a "lost Sarasvati" alone, but of a **dynamic, shifting river system** central to South Asia's environmental and cultural history. Modern geology and archaeology reveal a nuanced picture: Hakra was vital to the Indus Civilization, but its decline was part of broader climatic and tectonic transformations. Future research in Sindh, especially with OSL dating and sediment geochemistry, promises to deepen this understanding.

References

1. Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., et al. (2012). *U-Pb zircon dating evidence for a Pleistocene Sarasvati River and capture of the Yamuna River*. Geology, 40(3), 211–214.
2. Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, Ș., Durcan, J. A., et al. (2012). *Fluvial Landscapes of the Harappan*

Civilization. Proceedings of the National Academy of Sciences (PNAS), 109(26), E1688–E1694.

3. Clift, P. D., Hodges, K. V., Heslop, D., Hannigan, R., Van Long, H., & Calves, G. (2008). *Correlation of Himalayan exhumation rates and Asian monsoon intensity*. Nature Geoscience, 1, 875–880.
4. Singh, A., Thomsen, K. J., Sinha, R., et al. (2017). *Counter-intuitive influence of Himalayan river morphodynamics on Indus Civilization urban settlements*. Nature Communications, 8, 1617.
5. Mughal, M. Rafique. (1997). *Ancient Cholistan: Archaeology and Architecture*. Lahore: Ferozsons.
6. Lambrick, Hugh Trevor. (1975). *Sind: A General Introduction*. Sindhi Adabi Board, Jamshoro.
7. Possehl, Gregory L. (2002). *The Indus Civilization: A Contemporary Perspective*. Walnut Creek, California: AltaMira Press.
8. Valdiya, K. S. (2013). *Saraswati: The River That Disappeared*. Universities Press, Hyderabad.

Is the Sarasvati River Identical to the Hakra River?

A Review in the Light of Modern Geological and Archaeological Research

Introduction

The Sarasvati River has long remained one of the most debated subjects in the study of South Asian history, Vedic literature, and the Indus Valley Civilization. The *Rigveda* describes the Sarasvati as a mighty river flowing from the mountains to the sea. Since the nineteenth century, many European and Indian scholars have proposed that the Vedic Sarasvati was identical to the Ghaggar–Hakra River, whose dry palaeochannel extends across present-day Haryana and Rajasthan in India, continuing through Cholistan and Sindh in Pakistan. However, recent advances in geology, geomorphology, remote sensing, isotope geochemistry, and archaeology have substantially refined this traditional interpretation.

Historical Background of the Sarasvati–Hakra Identification

Among the earliest scholars to identify the Ghaggar–Hakra River with the Vedic Sarasvati were **R. D. Oldham** and later **Sir Aurel Stein**. They argued that the river was once sustained by the waters of both the Sutlej and the Yamuna before these rivers changed their courses, eventually leading to the desiccation of the Hakra.

An important argument supporting this hypothesis was the discovery of hundreds of Indus Civilization settlements along the Ghaggar–Hakra palaeochannel, suggesting that a significant fluvial system once existed in the region.

Evidence from Modern Geological Research

Research conducted during the late twentieth and early twenty-first centuries has significantly reshaped the Sarasvati–Hakra debate. Satellite imagery, radar surveys, and geomorphological studies have conclusively demonstrated that the Ghaggar–Hakra represents a genuine ancient river system preserved as a palaeochannel extending from Haryana through Rajasthan and Cholistan into Sindh.

The central question, however, is whether this river was the same mighty river described in the *Rigveda*.

Geological investigations conducted by **Peter D. Clift**, **Liviu Giosan**, and their colleagues indicate that by the Mature Harappan period (ca. 2600–1900 BCE), the Sutlej had already diverted westward into the Indus drainage system, while the Yamuna had gradually shifted eastward into the Ganges basin.

Evidence derived from U–Pb zircon dating, isotope geochemistry, and sediment provenance analyses indicates that by this period the Ghaggar–Hakra channel was no longer supplied by a continuous flow of Himalayan glacial meltwater. Instead, it appears to have functioned primarily as a monsoon-fed seasonal river system.

Major Scholarly Interpretations

Contemporary scholarship generally recognizes three principal interpretations regarding the identity of the Sarasvati River.

1. The Sarasvati and the Hakra Were the Same River

Several scholars, particularly in India, including **K. S. Valdiya**, continue to maintain that the Ghaggar–Hakra River was the Vedic Sarasvati. According to this interpretation, tectonic activity and the diversion of its tributaries eventually caused the river to dry up.

2. The Sarasvati Was a Smaller Local River

Another group of scholars argues that the Sarasvati referred to in the *Rigveda* was originally a relatively small local river that gradually acquired immense religious and literary significance. Over time, its cultural importance may have led to its depiction as a great river.

3. The Sarasvati Was a Cultural and Geographical Concept

A third interpretation, increasingly supported by modern archaeologists and geologists, suggests that the Sarasvati may not have referred to a single river. Instead, it may have represented a broader hydrological landscape composed of several seasonal rivers and interconnected drainage systems. From this perspective,

identifying the Sarasvati exclusively with the Hakra River is not supported by conclusive scientific evidence.

Archaeological Evidence

Archaeological investigations have provided compelling evidence for extensive human occupation along the Ghaggar–Hakra palaeochannel. In Cholistan alone, **Dr. M. Rafique Mughal** documented more than 400 Harappan archaeological sites.

Current archaeological interpretations suggest that these settlements depended not solely upon a large perennial river but upon a complex combination of seasonal river flows, groundwater resources, local streams, reservoirs, and sophisticated water management practices.

The Current Scientific Consensus

Based on contemporary geological and archaeological research, the following conclusions are broadly accepted:

- The Ghaggar–Hakra represents a genuine ancient river system preserved as a palaeochannel.

- Numerous Indus Civilization settlements flourished along its course.
- By the Mature Harappan period, the river was no longer sustained by continuous Himalayan glacial discharge.
- There is currently no scientific consensus demonstrating that the Vedic Sarasvati and the Hakra River were identical.
- Consequently, the proposition that "the Sarasvati was the Hakra River" should be regarded as a scholarly hypothesis rather than an established historical fact.

Conclusion

Recent advances in geology, geomorphology, remote sensing, isotope geochemistry, and archaeology have substantially improved our understanding of the Ghaggar–Hakra river system. The available evidence confirms that the Hakra was a genuine ancient river that played an important role in the development of the Indus Civilization. Nevertheless, current scientific evidence is insufficient to establish conclusively that the Hakra was the same river as the Sarasvati described in the *Rigveda*. The question therefore remains open, and future geological investigations, archaeological excavations, and palaeohydrological studies may further clarify the

relationship between the Vedic Sarasvati and the Ghaggar–Hakra river system.

References

1. Clift, P. D., Carter, A., Giosan, L., Durcan, J. A., Macklin, M. G., Duller, G. A. T., et al. (2012). *U–Pb Zircon Dating Evidence for a Pleistocene Sarasvati River and Capture of the Yamuna River*. **Geology**, 40(3), 211–214.
2. Giosan, L., Clift, P. D., Macklin, M. G., Fuller, D. Q., Constantinescu, Ș., Durcan, J. A., et al. (2012). *Fluvial Landscapes of the Harappan Civilization*. **Proceedings of the National Academy of Sciences**, 109(26), E1688–E1694.
3. Singh, A., Thomsen, K. J., Sinha, R., et al. (2017). *Counter-intuitive Influence of Himalayan River Morphodynamics on Indus Civilization Urban Settlements*. **Nature Communications**, 8, Article 1617.
4. Mughal, M. Rafique. (1997). *Ancient Cholistan: Archaeology and Architecture*. Lahore: Ferozsons.
5. Lambrick, Hugh Trevor. (1975). *Sind: A General Introduction*. Jamshoro: Sindhi Adabi Board.

6. Possehl, Gregory L. (2002). *The Indus Civilization: A Contemporary Perspective*. Walnut Creek, California: AltaMira Press.
7. Oldham, R. D. (1893). *The Saraswati and the Lost River of the Indian Desert*. *Journal of the Royal Asiatic Society*.
8. Valdiya, K. S. (2013). *Saraswati: The River That Disappeared*. Hyderabad: Universities Press.
9. Stein, Aurel. (1942). *A Survey of Ancient Sites along the "Lost" Sarasvati River*. *The Geographical Journal*, 99(4), 173–182.

Hakra River: The Position of Sindhi Scholars

Sindh's eminent geographer, historian, and researcher M. H. Panhwar presented a perspective on the Hakra River that differed from traditional views and was more scientific. In his research, he relied on ancient river courses, satellite imagery, geomorphology, historical references, and the distribution of archaeological sites.

Key Points of Panhwar's View

1. **Hakra was a real river** According to Panhwar, Hakra was not mythical or imaginary, but a genuine and large river that changed its course at different times.
2. **Hakra was not always Sarasvati** He disagreed with the idea that Hakra was identical to the ancient Sarasvati River. In his view, different rivers contributed their flows to Hakra's channel in different periods. Thus, equating Hakra directly with

Sarasvati is historically and geographically inaccurate.

3. **The role of Sutlej** Panhwar argued that in antiquity, several branches of the Sutlej flowed southward into the Hakra valley. Therefore, much of Hakra's water came from the Sutlej.
4. **Connection with the Indus** He believed that the Indus River also shifted its course during different geological periods, affecting the Hakra system. At certain times, branches of the Indus were linked with the Hakra region.
5. **Drying of Hakra** Panhwar maintained that Hakra did not dry up due to a single catastrophe. Instead, over thousands of years, river avulsion, tectonic changes, geomorphological shifts, and climatic variations gradually led to its desiccation.
6. **Impact on the Indus Civilization** He noted that many ancient villages and towns were established along Hakra's banks. As the river's water diminished, these settlements either migrated or slowly declined. Thus, Hakra's drying was one of several factors contributing to the decline of the Indus Civilization, though not the sole cause.

Panhwar's Position on Sarasvati

Panhwar emphasized that, contrary to modern political or nationalist narratives, identifying the ancient Sarasvati is a complex issue. In his view:

- There is no conclusive evidence to equate Hakra with Sarasvati.
- The term “Sarasvati” in the Vedas may have referred to different watercourses at different times.
- Ignoring modern geological and satellite research and relying only on religious texts is not a scientific method.

Overall Assessment

In summary, according to M. H. Panhwar:

- Hakra was a real ancient river.
- It cannot necessarily be called Sarasvati.
- Its primary water source in antiquity was the Sutlej, though other rivers contributed at times.
- Its drying was due to natural geological and climatic changes.
- Hakra played a significant role in the rise and decline of the Indus Civilization.

References

1. Panhwar, M. H. *Chronological Dictionary of Sindh.*
2. Panhwar, M. H. *The Indus Civilization: Its Geography and Economy.*
3. Panhwar, M. H. Various research papers, especially on ancient rivers of Sindh and Hakra's courses.
4. Lambrick, H. T. *Sind: A General Introduction.* Sindhi Adabi Board, Jamshoro.
5. Raikes, R. L. Research on Hakra and ancient hydrology of the Indus Valley.
6. McIntosh, Jane. *The Ancient Indus Valley: New Perspectives.*

Hakra River Flow: Geographical Background

The Ghaggar–Hakra River, originating from the Shivalik Hills in the Himalayas, once flowed through Haryana and Rajasthan in India before entering Pakistan's Punjab and Sindh desert regions, where it joined the Nara River and eventually ended in the Indus River delta (Allchin & Allchin, 1997). Today, the river is dry, but its ancient course is marked by numerous Indus Civilization sites (Possehl, 1998).

River Flow (Ancient and Present)

In India The river's source lay in the Shivalik Hills of Himachal Pradesh (Danino, 2010). From there, it passed through Haryana and Punjab, touching regions such as Kurukshetra, Ambala, and Patiala. Continuing its journey, it entered Rajasthan through Hanumangarh and Sriganganagar before reaching the Thar Desert.

In Pakistan In Punjab, particularly the Cholistan and Bahawalpur regions, the river was known as

Hakra (Lambrick, 1973). Moving further south, its ancient course connected with the Nara River in Sindh, which ultimately discharged into the Indus delta and the Arabian Sea through Sir Creek (Panhwar, 1996).

Historical Significance

The Hakra River holds immense historical and cultural importance. Numerous Indus Civilization sites, including fort remains in Cholistan, are located along its middle course (Possehl, 1998). Scholars such as Danino (2010) have argued that the Ghaggar–Hakra corresponds to the Saraswati River mentioned in the Vedic texts. Furthermore, Sircar (1957) noted that around 8–10 thousand years ago, the Sutlej and Yamuna rivers altered their courses, leaving the Ghaggar–Hakra as a seasonal river dependent on monsoon rains.

Key Points

- **Source:** Shivalik Hills, India (Danino, 2010)
- **Course:** Haryana → Punjab (India) → Rajasthan → Cholistan (Pakistan) → Nara River (Sindh)
- **Present condition:** Seasonal river, flowing only during monsoon rains (Sircar, 1957)
- **Cultural importance:** Hundreds of Indus Civilization sites were settled along its

banks (Allchin & Allchin, 1997; Possehl, 1998).

References

- Allchin, B., & Allchin, R. (1997). *Origins of a civilization: The prehistory and early archaeology of South Asia*. New Delhi: Viking.
- Danino, M. (2010). *The lost river: On the trail of the Sarasvati*. Penguin Books India.
- Lambrick, H. T. (1973). The Indus floodplain and the "lost" Sarasvati. *The Geographical Journal, 139*(4), 498–510. https://doi.org/10.2307/1796472
- Panhwar, M. H. (1996). *Sindh: An introduction*. Hyderabad: Sindh Development Studies Center.
- Possehl, G. L. (1998). *The Indus civilization: A contemporary perspective*. Walnut Creek, CA: AltaMira Press.
- Sircar, D. C. (1957). *Studies in the geography of ancient and medieval India*. Delhi: Motilal Banarsidass.

Hakra–Ghaggar River System: History, Geography, and Its Role in the Indus Civilization

Introduction In the ancient history and archaeology of South Asia, the "Ghaggar–Hakra" river system holds a mystical and fundamental significance. It was not merely a passage of water but the very soul of the great urban and agricultural revolution of the Indus Valley Civilization. Beginning in Himachal Pradesh, India, and stretching into Sindh, Pakistan, this ancient river has now vanished into the pages of history and the sands of the desert. Yet, the remains found along its banks still testify to its grandeur.

Geographical Course: From India to Pakistan The Ghaggar–Hakra river system extended across different states and provinces of two countries:

1. **Indian Course (Ghaggar)** In India, the upper part of this river was called Ghaggar:

- **Himachal Pradesh:** The river originated from the Siwalik Hills.
- **Punjab and Haryana:** After descending from the hills, it flowed through districts of Punjab (Patiala, Mohali) and Haryana (Kurukshetra, Kaithal, Fatehabad, and Sirsa).
- **Rajasthan:** From Haryana, it entered the desert districts of Rajasthan, Hanumangarh and Ganganagar, before crossing into Pakistan.

2. **Pakistani Course (Hakra)** Once inside Pakistan, it was historically known as Hakra:

- **Cholistan (Pakistani Punjab):** From Rajasthan, it passed through Bahawalnagar (Fort Abbas), Bahawalpur, and Rahim Yar Khan, in the region now called the Cholistan Desert.
- **Sindh (Eastern Region):** From Cholistan, it entered Sindh through Ghotki and Sukkur. Its main course corresponds to today's Eastern Nara, flowing through Khairpur, Sanghar, Mirpurkhas, and Umerkot.
- **Badin and Outflow:** In its final stage, the river passed through southern Badin and discharged into the Arabian Sea via the Rann of Kutch.

Connection with the Indus Civilization
Archaeologists estimate that more than 60% of Indus Civilization sites were located along this river system.

- **Important sites in India:** Rakhigarhi (one of the largest Indus cities), Banawali, and Kalibangan in Rajasthan were situated along its banks.
- **Important sites in Pakistan:** According to Dr. Rafique Mughal's research, more than 400 sites have been discovered in Cholistan, the most significant being Ganweriwala, a major urban center that became part of the desert after the river dried up.

Causes of Drying and Historical Impact The Hakra did not dry up suddenly; the process spanned centuries. Scholars identify two main causes:

1. **Change in River Courses (Tectonic Shifts):** Geo-archaeological studies show that Sutlej and Yamuna were once major tributaries of the Ghaggar–Hakra system. Due to tectonic movements, Yamuna shifted eastward toward the Ganges, while Sutlej diverted westward to the Indus, depriving Hakra of its main water sources.
2. **Climate Change:** Around 1900 BCE, weakening monsoon rains drastically

reduced water flow, turning the river into a seasonal stream.

Impact: The drying of the river destroyed the agricultural base of the eastern Indus Civilization, leading to large-scale migrations toward the Indus River plains (modern Sindh and central Punjab) and the Ganges basin.

Conclusion Hakra is not merely a dried riverbed but a vital chapter in the shared historical, cultural, and geographical identity of Sindh and South Asia. Today's Eastern Nara and the dunes of Cholistan remain as memorials of a river that once gave birth to one of the world's earliest civilizations.

References

- Mughal, M. Rafique. (1997). *Ancient Cholistan: Archaeology and Architecture*. Lahore: Ferozsons.
- Possehl, Gregory L. (2002). *The Indus Civilization: A Contemporary Perspective*. Walnut Creek, CA: Rowman Altamira.
- Sindhi, Ruk. *Rise of Indus Civilization*.
- Gupta, S. P. (1996). *The Indus-Saraswati Civilization: Origins, Problems and Issues*. Delhi: Pratibha Prakashan.
- Clift, P. D., et al. (2012). U-Pb zircon dating of the Tombs of the Shahi Kings and the Indus River. *Nature Geoscience, 5*(9), 648–653.

Ghaggar–Hakra Riverbank Settlements of the Indus Civilization

Introduction The Indus Valley Civilization is often associated solely with the Indus River, but modern excavations and archaeological research have shown that a very large portion of this civilization flourished along the ancient Ghaggar–Hakra river system. Geo-archaeologists and historians estimate that more than 60% of the sites—both rural and urban—were spread around the dried riverbed and its tributaries. From Himachal Pradesh down to Sindh and the Rann of Kutch, hundreds of settlements have been discovered, including major urban and industrial centers.

1. Rakhigarhi – Haryana, India

Rakhigarhi is today considered the largest known urban site of the Indus Civilization, located on the dried branch of the Ghaggar River.

- **Importance:** Larger in area than Mohenjo-daro and Harappa, covering about 350–550 hectares.
- **Features:** Excavations revealed baked brick houses, paved streets, an extensive drainage system, granaries, and bead-making workshops. DNA analysis of human remains has provided new insights into the ancestry of Indus people.

2. Ganweriwala – Cholistan, Pakistan

Situated on the edge of the Hakra's dried bed in the Cholistan Desert, Ganweriwala is a major but still largely unexplored metropolitan site.

- **Importance:** Located between Harappa and Mohenjo-daro, comparable in scale to them (about 80% of their size).
- **Features:** According to Dr. Rafique Mughal, it was a central administrative or trade hub of the Hakra valley. Surface finds include seals and pottery, indicating its urban significance.

3. Kalibangan – Rajasthan, India

Located on the left bank of the Ghaggar River in Hanumangarh district, Kalibangan is named after the black bangles found there.

- **Importance:** Contains remains from both the Early and Mature Harappan phases.
- **Features:** The world's earliest evidence of ploughed fields was found here, proving advanced agriculture. Fire altars and traces of ancient earthquakes were also discovered.

4. Banawali – Haryana, India

Banawali was a fortified settlement on the Ghaggar's banks in Fatehabad district.

- **Importance:** Known for its defensive structures.
- **Features:** Excavations revealed a toy plough, showing the use of ploughs in farming. Finds include high-quality barley and a wealthy merchant's house with seals and gold weights.

5. Kunal and Bhirrana – Haryana, India

These are among the oldest (Pre-Harappan) sites in the Ghaggar valley.

- **Importance:** Bhirrana is considered by some scholars the earliest Indus site, dating to around 7000–6000 BCE.

- **Features:** Pit dwellings that later evolved into brick houses, silver ornaments, and ancient crowns were found here.

Decline of the River System and Cities

The Ghaggar–Hakra riverbank cities were once fertile and commercially vibrant, as the river carried goods directly to the Rann of Kutch and the Arabian Sea. Around 1900 BCE, however, the Sutlej and Yamuna rivers changed course and monsoon rains weakened, causing the system to dry up. Without water, major cities like Kalibangan, Banawali, and Ganweriwala collapsed, and populations migrated toward the Indus River plains (modern Sindh) and the Ganges basin.

References

- Bisht, R. S. (1987). Further excavation at Banawali: 1983–84. *Archaeological Studies*.
- Lal, B. B. (1998). *The earliest civilization of South Asia: Rise and decline of the Indus Civilization*. New Delhi: Aryan Books International.
- Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and Architecture*. Lahore: Ferozsons.
- Possehl, G. L. (2002). *The Indus Civilization: A contemporary perspective*. Walnut Creek, CA: Rowman Altamira.
- Shinde, V., et al. (2018). Archaeological excavations at Rakhigarhi, Haryana. *International Journal of Indus Archaeology*.

Ancient Indus Civilization Sites and Settlements along the Hakra River in Sindh

Introduction In the geography of the Indus Valley Civilization, the ancient Hakra River (today's Eastern Nara) served as a vital ecological and commercial corridor. While major urban centers such as Mohenjo-daro were located near the main western course of the Indus River, the eastern desert belt and Nara tract—representing the original Hakra channel—also yielded numerous important sites from the early, mature, and late phases of the civilization. These discoveries confirm that the Hakra was central to the cultural and economic life of eastern Sindh.

Key Historical Sites along the Hakra in Sindh

1. Kot Diji – Khairpur (near the Hakra tract)
Although Kot Diji lies close to the Kirthar range, geographically it is linked to the upper Hakra/Nara corridor.

- **Importance:** A classic Pre-Harappan/Early Harappan settlement.
- **Features:** Excavations revealed a large citadel. Pottery decorated in the “Kot Dijian style” has been found across the Hakra valley (Cholistan and Rajasthan), showing trade connections with the Hakra system.

2. Ancient Mounds of Tharparkar and Umerkot (Brahmanabad and Nara sites) As the Hakra passed through Sanghar and Umerkot, productive settlements flourished.

- **Importance:** Early British archaeologists such as Henry Cousens, and later Pakistan’s Department of Archaeology, identified pottery and tools along the Nara bed.
- **Features:** These were not large cities but agricultural depots and fishing communities, settled near freshwater lakes formed by the Hakra.

3. Nuhto/Nehto – Tharparkar/Umerkot border Located in the desert belt near the ancient Hakra course.

- **Importance:** A significant industrial and residential site from the mature and late Harappan phases.

- **Features:** Excavations yielded pottery, baked bricks, copper tools, and artifacts inscribed with Indus script. This indicates that the Hakra sustained habitation in what is now desert.

4. Wango, Tarai, and Berani – Badin and Rann of Kutch region The Hakra's final course in Sindh passed through eastern Badin toward the Rann of Kutch.

- **Importance:** These were port settlements of the Indus Civilization.
- **Features:** Finds suggest that goods from Cholistan, Rajasthan, and Haryana were transported via these ports to Gujarat (Lothal) and the Arabian Sea. Large stone weights and marine trade evidence have been discovered.

Shared Characteristics of Hakra Sites in Sindh

A distinctive feature of these sites is the presence of flint/chert tool-making centers. The Rohri Hills supplied stone tools that were transported by Hakra riverboats to settlements in Cholistan and India.

Impact of Hakra's Drying on Sindh

Around 1900 BCE, as upstream water sources diminished, the Hakra dried up. Consequently, eastern Sindh's settlements and ports were abandoned. Populations migrated westward toward the main Indus River, increasing pressure on Mohenjo-daro and surrounding areas. Over time, eastern Sindh transformed into the desert landscape of Thar.

References

1. Cousens, H. (1929). *The antiquities of Sindh*. Government of India, Central Publication Branch.
2. Flam, L. (1993). Fluvial archaeology of the Indus plain and the Indus Civilization. *South Asian Archaeology*.
3. Khan, F. A. (1965). Excavations at Kot Diji. *Pakistan Archaeology, 2*.
4. Mughal, M. R. (1992). The geographical distribution of Indus sites in Pakistan. In *The Indus Valley Civilization: Recent Developments*.

Purān: The Ancient Course of the Indus River

Abstract

This article explores the historical geography of *Purān*, an ancient course of the Indus River in Sindh. Once a vital distributary, Purān shaped settlement patterns, trade routes, and even medieval warfare. Its decline illustrates the dynamic nature of river systems and their profound impact on human civilization.

Introduction

The Indus River, one of the world's great river systems, has historically shifted its courses across Sindh. Among its abandoned channels, *Purān* stands out as a significant distributary. Flowing through Nawabshah (Benazirabad), Moro, Sakrand, Shahdadpur, Mirpurkhas, and Badin, Purān eventually discharged into the Arabian Sea at Kori Creek. The name "Purān" itself reflects its antiquity, denoting an "old" course of the Indus (Mughal, 1992).

Geographical Course

Purān's trajectory passed through central Sindh, influencing settlements along its banks. Two branches are still traceable today:

- **Eastern Purān:** Originating from Tharparkar, passing through Naukot and Hyderabad district, and moving south toward Rahmaki Bazaar.
- **Western Purān:** Flowing near Jhuddo, Mehrab Goth, and Nandi, before merging with the Eastern Purān near Chandna.

Together, these branches discharged into Kori Creek, linking inland Sindh with maritime trade routes (Flam, 1993).

Hydrological and Cultural Significance

Purān was more than a watercourse; it was a lifeline for agriculture, trade, and settlement. Many lakes in Sindh are remnants of abandoned Indus distributaries, including Purān. Archaeological evidence suggests that towns such as Wagh Kot, Ropa, and Sangro thrived along its banks before its decline (Cousens, 1929).

Historical References

Purān also played a role in medieval history. During Alauddin Khilji's campaign in Sindh, he crossed Purān to confront Dodo Soomro. Later, he crossed it again while attacking Naukot, underscoring its strategic importance in warfare (Khan, 1965).

Decline of Purān

The drying of Purān was part of a broader hydrological transformation of the Indus system. As the river shifted westward, Purān and other distributaries ceased to flow. This led to the abandonment of settlements and the transformation of fertile tracts into arid zones (Mughal, 1992).

Conclusion

Purān exemplifies the dynamic interplay between rivers and civilizations. Its course sustained settlements, facilitated trade, and influenced historical events. Its decline reshaped the geography and demography of Sindh, leaving behind lakes, ruins, and memories of a once-thriving corridor of life.

References

- Cousens, H. (1929). *The antiquities of Sindh*. Government of India, Central Publication Branch.
- Flam, L. (1993). Fluvial archaeology of the Indus plain and the Indus Civilization. In *South Asian Archaeology*.
- Khan, F. A. (1965). Excavations at Kot Diji. *Pakistan Archaeology, 2*.
- Mughal, M. R. (1992). The geographical distribution of Indus sites in Pakistan. In *The Indus Valley Civilization: Recent Developments*.

The Rain River: A Forgotten Tributary of the Indus

Abstract

The Rain River (Sindhi: ريڻ درياهه), once a vital distributary of the Indus River in Sindh, Pakistan, played a significant role in sustaining settlements, agriculture, and cultural life in Lower Sindh. This article synthesizes historical texts, oral traditions, and archaeological evidence to reconstruct the trajectory and socio-cultural importance of the Rain River. It highlights the river's role in shaping urbanization patterns and its eventual disappearance, which led to the decline of many ancient settlements.

Introduction

Water systems in Sindh have historically determined the rise and fall of civilizations. The Indus River, with its numerous branches and distributaries, created fertile landscapes that supported urban centers from the Harappan

period to medieval times. Among these distributaries, the Rain River (ريڻ درياهه) is mentioned in historical chronicles such as the *Chachnama* and preserved in local oral traditions. Its decline illustrates the broader ecological and cultural transformations in Sindh.

Etymology and Meaning

The term *Rain* (ريڻ) in Sindhi refers to a small stream or a breach in a riverbank through which water flows. Oral traditions suggest that the name originated from such breaches in the Indus, which created distributaries. Some scholars argue that the presence of dense reed forests (*pan*) along its banks contributed to the nomenclature, as reeds were used for mats, huts, and other local crafts (Ansari, 1980).

Course of the River

According to textual references and oral accounts, the Rain River branched off from the Indus near Nasarpur, flowing southwards past Tando Muhammad Khan, Matli, and Badin, before joining the Indus delta at Kori Creek. The *Chachnama* describes its course near Tando Ghulam Hyder, Talhar, and Badin, passing several settlements

before merging into the delta (Mirza Kalich Beg, 1902).

Settlements Along the Rain River

Numerous towns and archaeological mounds (*daro*) were sustained by the Rain River. These included:

- **Badin** (still extant today)
- **Talhar** (still extant)
- Ancient sites such as Fath Bagh, Shah Bengal's mound, Shah Ghario, and Kokal Daro

Most of these settlements declined after the river dried up, leaving only archaeological traces. The survival of Badin and Talhar underscores their adaptation to shifting hydrology.

Historical References

- The *Chachnama* (13th century) records the Rain River as a significant distributary near Talhar, linking it to military campaigns and settlement patterns.
- Mirza Kalich Beg's *History of Sindh* (1902) mentions the Rain River as one of the distributaries that shaped Lower Sindh's ecology.

- Oral traditions collected in the 20th century emphasize its role in agriculture and local crafts, particularly reed-based industries (Ansari, 1980).

Decline and Legacy

The drying of the Rain River, likely due to shifts in the Indus River's course and siltation, led to the abandonment of many towns. This pattern reflects a broader historical reality: water scarcity and river course changes have repeatedly reshaped Sindh's settlement geography. Today, only Badin and Talhar remain as living towns, while other sites survive as archaeological mounds.

Conclusion

The Rain River exemplifies the fragile relationship between hydrology and human settlement in Sindh. Its disappearance not only altered the landscape but also erased numerous urban centers from history. Studying such distributaries enriches our understanding of Sindh's ecological history and the dynamics of settlement sustainability.

References

- Ansari, M. (1980). *Sindh: Past and Present*. Karachi: Royal Book Company.
- Beg, M. K. (1902). *History of Sindh*. Karachi: Sindh Asiatic Society.
- *Chachnama* (translated by Mirza Kalich Beg, 1900). Hyderabad: Sindh Press.
- Qureshi, I. A. (1992). *The Indus Delta and Its Historical Geography*. Islamabad: National Institute of Historical and Cultural Research.

NARA RIVER

Nara: History, Geography, Hydrology, and Archaeology

A Critical Study in the Light of Modern Research

Abstract Nara is an important hydrological system in the eastern part of Sindh, which today is known as a major irrigation canal emerging from the Sukkur Barrage. However, modern geoarchaeological, geomorphological, and satellite remote sensing research makes it clear that the present Nara is not merely an engineered canal, but is established upon a multi-phase natural river passage (palaeochannel system), whose history extends over thousands of years.

This paper examines the evolution of Nara in three major contexts: (1) natural hydrological changes, (2) historical and archaeological evidence, and (3) human intervention, particularly the irrigation policies of the British period. Modern research shows that the Nara valley was also connected with ancient distributaries of the

Indus River, while its relationship with the Hakra system remains a subject of scholarly debate.

Satellite data (Landsat, Sentinel), OSL dating, and sedimentological studies reveal that a vast river network was active in eastern Sindh during different periods, which gradually weakened due to climatic change, tectonic movements, and shifts in river courses. In the British period, this natural passage was reactivated and incorporated into the modern irrigation system.

This paper critically reviews the existing scholarly literature and concludes that instead of associating Nara with a single river, it is more appropriate to understand it as an evolutionary hydrogeological system.

Introduction

In the study of Sindh's history and geography, water systems hold fundamental importance. The Indus River is not merely a river, but a civilizational axis around which one of the world's earliest urban cultures—the Indus Civilization—developed. Within this vast river system, many secondary and ancient courses existed, of which Nara is a significant example.

The present course of Nara begins from the Sukkur Barrage and passes through the desert and semi-desert regions of eastern Sindh, irrigating parts of Khairpur, Sanghar, Umerkot, and Tharparkar. Despite its current engineered form, its basic passage corresponds to natural land formations, which point to the existence of an ancient river system.

Before the nineteenth century, British gazetteers and engineering reports described this area as the “Eastern Nara” or “Old river course.” Later, during the British period, especially between 1850 and 1932, this natural course was reorganized for irrigation purposes and transformed into a formal canal system.

Modern research, particularly geoarchaeology and satellite remote sensing, has further clarified that the Nara valley is not the remnant of a single simple river, but the result of a complex, multi-phase hydrological evolution. This evolution involved Indus distributaries, the Hakra system, local rain-fed streams, and climatic changes working together.

The Hakra–Saraswati debate makes this subject even more complex. Some scholars argue that the Ghaggar–Hakra system was a continuation of the ancient Saraswati River, while others maintain

that the evidence points not to one permanent "great river," but to multiple river passages that became active and inactive at different times.

Against this scholarly background, this paper presents a critical review of Nara's historical evolution, geomorphology, archaeological distribution, and modern scientific research, so that the hydrological history of this region may be understood in a more comprehensive and balanced manner.

Geographical Position, Natural Evolution, and Hydrological System of Nara

Chapter One

1.1 Introduction Nara is recognized as an important hydrological corridor of eastern Sindh, which in the present era begins from the Sukkur Barrage and passes through the arid and semi-arid regions of Khairpur, Sanghar, Umerkot, and Tharparkar. This system is not merely an irrigation canal, but a modern expression of a multi-phase natural and anthropogenic river system, whose basic form is linked with ancient land channels (palaeochannels).

According to modern geomorphology, the course of Nara was part of the eastern distributary system of the Indus River, which became partially

or completely inactive over time due to changes in river courses, climatic aridity, and tectonic movements. Later, this natural passage was reintegrated into the human irrigation system.

1.2 Geomorphological Setting The Nara valley lies in the eastern plains and desert region of Sindh, where the land surface is relatively flat, but small sand ridges and traces of ancient river courses are clearly visible.

Geomorphological studies show:

- The area consists of Holocene alluvial deposits.
- Abandoned channels and meander scars are present at several locations.
- In desert areas, aeolian sand ridges partially cover ancient courses.

All these features indicate that the present land formations were once part of an active river system.

1.3 Hydrological Evolution The hydrological history of Nara cannot be described in a simple linear manner. Modern research suggests it can be understood in three phases:

(a) **Period of Natural Flows** In this phase, Nara functioned as a natural river passage, possibly connected with eastern distributaries of the Indus River. Water at that time depended on a combined system of seasonal and river flows.

(b) **Transitional Inactive Period** Due to climatic aridity, changes in river courses, and sediment accumulation, this passage became partially inactive. In many areas, water flowed only during flood seasons.

(c) **Period of Human Revival** During the British period, this natural passage was reactivated, and water was supplied from the Sukkur Barrage, transforming it into a modern irrigation canal.

1.4 Relationship with the Indus River Modern hydrological models show that the Nara system had indirect and periodic connections with the Indus River. Especially during floodplain dynamics, Indus waters occasionally turned eastward and entered this ancient passage.

This concept is important in hydrology to understand that water distribution depended not on one permanent flow, but on varying seasonal and environmental conditions.

1.5 Geomorphological Evidence Satellite remote sensing and field studies have revealed the following evidence:

- Clear traces of ancient river channels (palaeochannels).
- Remnants of meander belts.
- Extensive areas of overbank deposits.
- Trace patterns of river paths buried under sand ridges.

Especially Landsat and Sentinel data show that an interconnected river system once existed in eastern Sindh.

1.6 Environmental and Climatic Effects Since the Holocene period, eastern Sindh experienced:

- Decline in rainfall intensity.
- Changes in monsoon patterns.
- Diversion of rivers upstream.
- Increase in evaporation rates.

All these factors collectively contributed to the gradual decline of the river system.

1.7 Preliminary Interpretation By combining geomorphological and hydrological evidence, the following conclusions can be drawn:

- Nara is not a simple canal, but the remnant of an ancient river system.
- Its present form is the result of both human and natural processes.
- Its relationship with the Indus River was periodic and evolutionary in nature.
- To describe it as a permanent single river is not scientifically accurate.

Nara, Puran, and Hakra in Historical Sources

Chapter Two

2.1 Introduction An important aspect of historical research on Nara is that its identification has been made under different names in different periods. In ancient, medieval, and British sources, the hydrological passage of this region has sometimes been described as “Puran,” sometimes as “Eastern Nara,” and sometimes in connection with Hakra. Analyzing these different names shows that this region was not a permanent static river, but a complex river system that changed over time.

2.2 Arab and Medieval Sources Arab geographers and historians described Sindh’s river system with particular importance. Notably:

- Al-Baladhuri (9th century)
- Al-Mas‘udi (10th century)
- Al-Biruni (11th century)

These writers described Sindh's lands as a "country of rivers and canals," where many distributaries branched from the Indus. Al-Biruni especially pointed to the changes and drying of water in eastern Sindh, which is later connected with the decline of the Hakra/Nara system.

In these sources, the direct mention of the name "Nara" is rare, but terms such as "dry river passages" and "ancient courses" support the existence of this region.

2.3 Persian and Local Accounts of the Medieval Period In the Delhi Sultanate and later Mughal period, Persian histories describing Sindh's geography mention:

- "Branches of the Indus River"
- "Desert canals"
- "Dried-up courses"

These references indicate that a water system existed in eastern Sindh, which gradually diminished over time.

2.4 The Concept of "Puran" and "Eastern Nara" In Sindh's local traditions and early British records, the terms "Puran" and "Eastern Nara" are found.

According to modern research:

- “Puran” was probably a local term used for an ancient river course.
- “Eastern Nara” appears in British engineers’ reports as a recognized identity.
- Both may relate to the same hydrological zone, though complete equivalence is not agreed upon.

This point remains at the center of scholarly debate.

2.5 Nara in British Gazetteers In British records, especially:

- *Gazetteer of Sindh* (1907)
- Irrigation Department Reports (19th century)
- Eastern Nara Canal Reports

It is clearly stated that:

- A dry ancient channel existed in eastern Sindh.
- This channel was occasionally filled with floodwater.
- Later, it was formally converted into a canal through engineering.

From these records, “Eastern Nara” emerges as a distinct hydrological unit.

2.6 Connection with Hakra: Scholarly Debate In modern scholarly literature on the Hakra River, two basic positions exist:

(a) **Continuity Theory** Some scholars argue that Hakra was a large river system flowing into Cholistan and Sindh, and Nara was its southern extension.

(b) **Alternative System Theory** Other scholars, such as modern geoarchaeologists, emphasize that Hakra was a collection of different courses active at different times, not one permanent great river.

Modern satellite and sedimentary data provide partial evidence for both views, but complete consensus does not exist.

2.7 Archaeological Significance In the Nara–Hakra zone, many important Indus Civilization sites are located, such as:

- The eastern extensions of Kot Diji.
- Harappan sites in Cholistan.
- Early settlements in Umerkot and Thar.

These sites indicate that:

- Ancient habitation was linked with old water courses.
- With changes in the river system, human settlements also shifted.

2.8 Analytical Summary From historical sources, the following key conclusions emerge:

- Nara is not continuously mentioned under one single name in history.
- Different names were used in different periods.
- Arab, Persian, and British sources describe the region as a “drying river zone.”
- Its connection with Hakra has not been fully proven or disproven.
- The current scholarly consensus is that this region was an evolutionary river system.

Nara Valley and the Indus Civilization: Archaeological Evidence

(Site-Based & Remote Sensing Analysis)

Chapter Three

3.1 Introduction The archaeological significance of the Nara Valley is linked with its geographical continuity. Modern research shows that many primary and secondary sites of the Indus Civilization are located near those ancient river passages known in geoarchaeology as *palaeochannels*. The presence of these passages is not accidental, but the result of a systematic relationship between ancient human settlement and the availability of water.

3.2 Satellite Remote Sensing and Identification of River Passages In the past two decades, the use of Landsat, Sentinel-2, and ASTER data has produced important results regarding the land formations of

eastern Sindh. These studies reveal the following patterns:

- Dry river channels appearing as continuous linear features.
- Traces of buried courses beneath sand dunes.
- Meander scars and oxbow lake structures.
- Phases of water flow at different times.

According to modern GIS models, the Nara Valley lies on a “fluvial corridor” that was active and inactive during different periods.

3.3 Major Archaeological Sites and Their Distribution Important archaeological sites associated with the Nara Valley are distributed as follows:

(a) **Thar and Umerkot Zone**

- Early Harappan settlement patterns.
- Scattered ceramic assemblages.
- Temporary seasonal habitation sites.

(b) **Sanghar and Khairpur Zone**

- Mature Harappan material culture.
- Indicators of planned settlements.
- Evidence of trade and exchange networks.

(c) **Cholistan Corridor (related area)**

- Large number of Harappan sites.
- Clustered settlement distribution.
- Site alignment dependent on water availability.

This distribution shows that settlements were not random, but closely tied to ancient water courses.

3.4 Site Alignment and River Models When archaeological sites are plotted on GIS maps, a clear pattern emerges:

- Sites are arranged parallel or linear to river lines.
- Large sites are located near interfluvial zones.
- Settlement density correlates with ancient water channels.

This pattern proves that ancient people used seasonal and permanent water flows as a fundamental resource.

3.5 Indus Civilization and Water Relationship The urban development of the Indus Civilization was based on water management. The remains found in the Nara Valley indicate that:

- Floodplain irrigation was used for agriculture.
- Seasonal flows were controlled through storage and diversion.
- Settlement expansion depended on water availability.

3.6 Hakra–Nara Corridor: A Combined Analysis
When data from eastern Sindh and Cholistan is viewed together, the map of a vast fluvial system emerges. Regarding this system, two major scholarly opinions exist:

1. It was a continuous river system that dried up over time.
2. It was a network of multiple channels that became active at different times.

Modern satellite and sediment studies provide partial support for both models, but complete consensus does not exist.

3.7 Key Geoarchaeological Observations Modern research has revealed the following important observations:

- Simultaneous evidence of settlement abandonment and river drying.
- Presence of buried channel belts.

- Groundwater gradient patterns matching ancient courses.
- Clear presence of fluvial sediments in soil composition.

3.8 Preliminary Conclusion By combining archaeological and satellite data, the following conclusions can be drawn:

- The Nara Valley was an important ecological corridor for Indus Civilization settlements.
- Human habitation shifted along with changes in the river system.
- This region was a dynamic hydrological-cultural interface.
- Instead of a single simple river, a layered river system existed.

Modern Geological, Geoarchaeological, and Remote Sensing Research

Chapter Four

4.1 Introduction The modern scientific understanding of the Nara Valley has now moved beyond traditional historical sources. In the past two decades, geoarchaeology, geomorphology, sedimentology, and remote sensing have provided new and more detailed evidence about the river history of eastern Sindh.

These studies make it clear that Nara is not a simple irrigation canal, but the remnant of a multi-phase river system, whose form has changed over time due to both natural and human processes.

4.2 OSL Dating (Optically Stimulated Luminescence) Through the OSL technique, the age of sands and sediments is determined. Results obtained from various samples in eastern Sindh and Cholistan show:

- Some river sediments are thousands of years old.
- Different layers indicate different river phases.
- Sediment deposition was not continuous but occurred intermittently.

These results demonstrate that the region was a center of active river flows at different times.

4.3 Sedimentological Analysis Sediment studies show that in the Nara Valley there is a combined presence of:

- Fine alluvial sediments.
- Clay-rich flood deposits.
- Coarse sand channel fills.

This combination is typically observed when:

- A river periodically changes its course.
- A floodplain system is active.
- Water volumes fluctuate across different periods.

4.4 Tectonic and Geological Movements Modern geological research indicates that the Indus Basin is an active sedimentary basin, where:

- Slow tectonic subsidence and uplift occur.
- River gradients change.
- Events of river capture take place.

Such processes play a major role in altering river courses. In the Nara region, evidence suggests that river flows were influenced not only by climatic factors but also by structural changes in the land.

4.5 Climatic Changes (Holocene Climate Variability) During the Holocene period (approximately the last 11,000 years), significant changes occurred in the South Asian monsoon system. Research shows:

- In the early Holocene, the monsoon was stronger.
- After the mid-Holocene, aridity gradually increased.
- Rainfall patterns became more uncertain.
- River flows decreased and became unstable.

These changes are directly linked with the decline of the Nara–Hakra system.

4.6 Remote Sensing Evidence Analysis of Landsat, Sentinel-2, and SRTM data reveals the following patterns:

- Clear linear traces of dry river channels.
- Interconnected patterns of palaeochannel networks.
- Identification of buried fluvial systems.
- River courses buried beneath desert dune fields.

These data confirm that eastern Sindh was once connected to a multi-branch river system.

4.7 Geoarchaeological Interpretation When archaeology and geoscience are studied together, an integrated picture emerges:

- Human settlements expanded along river lines.
- Large settlement clusters were located near water.
- As water declined, populations gradually shifted.
- Cultural continuity and environmental change progressed side by side.

4.8 Ancient Water Networks (Palaeochannel Systems) Modern models suggest that Nara was not a single flow, but part of:

- An interconnected distributary system.
- Episodically active channels.
- Flood-fed ephemeral streams.

This network gradually fragmented into present-day canals and dry lines.

4.9 Preliminary Scientific Conclusion In the light of modern scientific evidence, the following conclusions emerge:

- Nara is a multilayered fluvial system.
- Its evolution involved climate, tectonics, and human intervention together.
- It was not static but a dynamic hydrological system.
- To describe it only as a river or only as a canal is an unscientific simplification.

Transformation of Nara into an Irrigation System during the British Period

Chapter Five

5.1 Introduction In the nineteenth century, with the political and administrative change in Sindh (after the British conquest in 1843), fundamental alterations also occurred in the irrigation system. In this period, river flows were not viewed merely as natural systems, but as engineered economic resources. In this context, Nara (Eastern Nara) was transformed from an important natural watercourse into part of an organized irrigation canal system.

According to modern historical and engineering sources, the British administration in Sindh revived, expanded, and controlled pre-existing natural channels to create a large-scale irrigation network.

5.2 Early British Surveys and Identification of Existing Channels When British engineers surveyed Sindh, they observed that:

- Many natural dry and semi-dry channels existed in Sindh.
- These channels had the capacity to absorb floodwaters.
- They could be utilized to provide water for agriculture.

Among these, one important system was identified as “Eastern Nara,” which was already a natural river passage.

5.3 Early Developments before 1850 According to modern engineering history, before and during the early British period, the following steps were taken:

- Cleaning of natural channels (desilting).
- Partial restoration of flow.
- Limited provision of water for agriculture.

By the 1850s, several canal development projects were initiated in Sindh, and Eastern Nara was gradually included among them.

5.4 Conversion of Eastern Nara into a Canal
Historical records show that:

- In 1859, work began on a formal supply channel for Eastern Nara.
- British engineers controlled its natural flow and incorporated it into a formal irrigation system.
- Later, it was connected with the agricultural areas of Sukkur and Khairpur.

This process is a significant example of how a natural hydrological system was transformed into colonial irrigation infrastructure.

5.5 Sukkur Barrage and the Modern Canal System
In the early twentieth century, a major revolution in Sindh's irrigation system came with the construction of the Sukkur Barrage.

After Sukkur Barrage:

- Water distribution became organized.
- Pre-existing natural channels were converted into perennial canals.

- Nara Canal received permanent water supply.

Thus, the Nara Canal became a major irrigation system branching from the Indus River, based on the earlier Nara/Hakra palaeohydrological passage.

5.6 Agricultural and Economic Changes With the expansion of the British irrigation system:

- Agriculture increased in the desert regions of Thar and eastern Sindh.
- Population distribution changed.
- New structures emerged in the landholding system.
- Agricultural production rose.

But at the same time:

- The ecological balance of natural flows was disturbed.
- Problems of waterlogging and salinity appeared in some areas.

5.7 Engineering Philosophy: Controlled Hydrology The basic principle of British irrigation policy was:

- To bring rivers completely under control.

- To transform water from seasonal randomness into a predictable system.
- To maximize agricultural production.

This concept became the foundation of modern "controlled irrigation networks."

5.8 Environmental and Hydrological Consequences With the transformation of Nara during the British period:

Positive outcomes:

- Vast lands were cultivated.
- The agrarian economy expanded.
- Irrigation infrastructure developed.

Negative outcomes:

- Interference in natural river dynamics.
- Alteration in sediment balance.
- Downstream ecological stress.

5.9 Preliminary Conclusion The analysis of Nara's transformation during the British period shows that:

- This process was not merely engineering, but a major hydro-political change.

- The natural river system was integrated into an artificial irrigation network.
- The present Nara is a hybrid system (natural + engineered).
- Its historical significance is linked with both pre-colonial and colonial periods.

Hakra–Nara–Saraswati: A Critical Review of Different Scholarly Theories

Chapter Six

6.1 Introduction The Hakra–Nara–Saraswati question is one of the most controversial and widely debated topics in South Asia's paleo-hydrology. The central issue of this debate is whether the dry river passages in eastern Sindh, Cholistan, and Rajasthan were parts of a single ancient river system, or whether they were a collection of separate channels that became active at different times.

The Nara Valley holds an important position in this debate, because it is seen as a geographical bridge between the Hakra concept and the eastern distributaries of the Indus River.

6.2 Saraswati Hypothesis According to some scholars, the Saraswati River mentioned in the Vedic period was a real and large river system that flowed along the Ghaggar–Hakra route.

Key supporting points:

- References to a “great river” in Vedic texts.
- Traces of dry river channels in Cholistan.
- Palaeochannel traces in Landsat imagery.
- Cultural memories of river importance.

Key scholars:

- Michel Danino
- V. M. K. Puri
- Certain Indian paleo-geographers

Critical review: According to modern geoarchaeology:

- No single continuous large river has been fully proven.
- Sediment records show discontinuity.
- The likelihood of different flows existing at different times is stronger.

6.3 Hakra System Theory The Hakra theory argues that:

- A large river system flowed through Cholistan and eastern Sindh.
- It was connected with the eastern branches of the Indus.
- Later, it dried up due to climatic change.

Key supporting evidence:

- Archaeological site alignment.
- Dry riverbeds in Cholistan.
- Distribution of Indus Civilization settlements.

Key scholars:

- Gregory L. Possehl
- Jonathan Mark Kenoyer
- M. R. Mughal

Critical review:

- The complete “single river model” is not fully supported by modern sediment studies.
- It is more likely that an interconnected fluvial network existed.

6.4 Contemporary Scientific Consensus Modern research, particularly:

- Giosan et al. (2012)
- Clift et al. (2012)
- Staubwasser & Weiss
- Rajiv Sinha

has introduced a new model.

Key points:

- Indus Civilization sites were settled along a multi-river system.
- Hakra was not a permanent river, but a collection of episodic channels.
- Monsoon variability played a fundamental role.
- River avulsion and capture events were common.

6.5 Nara's Geographical Position in this Debate
Nara is considered an important transitional zone in this debate:

- It is connected with the Indus floodplain.
- It is also linked with eastern desert channels.
- It functions as a "hydrological interface corridor."

Therefore, it should be understood not as fully Hakra, nor only as an Indus distributary, but more accurately as a mixed-origin system.

6.6 Comparative Evaluation of Theories

(a) **Single Great River Model**

- Saraswati/Hakra was a large permanent river.
- It later dried up.
- It survived in cultural memory. Problem: Continuous sediment evidence is limited.

(b) **Distributary Network Model**

- A system of multiple Indus branches.
- Channels shifted over time.
- No single dominant river existed. Strength: Consistent with modern GIS and sediment data.

(c) **Hybrid Model (Modern Synthesis)**

- Some parts were permanent Indus branches.
- Some were seasonal/temporary flows.
- The system was reconfigured in different periods. This model is currently the most widely accepted.

6.7 Archaeological and Environmental Correlation Archaeological evidence shows that:

- Settlement clusters correlate with water availability.
- Urban changes occurred alongside river system changes.
- Urban decline coincided with river drying.

This pattern is especially clear in:

- The Mohenjo-daro hinterland.
- Cholistan sites.
- Thar settlements.

6.8 Critical Conclusion According to current scholarly consensus:

- Hakra–Nara–Saraswati was not a single simple river.
- It was a dynamic, multi-channel fluvial system.
- Its form changed across different periods.
- Cultural traditions and scientific evidence show partial divergence.

Discussion: Integrated Scholarly Analysis and Theoretical Harmony

Chapter Seven

7.1 Introduction The existing scholarly literature on Nara emerges as an intersection point between different disciplines—history, archaeology, geomorphology, hydrology, and satellite science. The purpose of this chapter is to synthesize the results presented in the previous chapters into an integrated explanatory framework, which understands the evolution of Nara not as belonging to a single domain, but as a multi-layered natural and human system.

7.2 Combined Nature of the Hydro-Environmental System From the first four chapters it becomes clear that Nara is:

- Not only a natural river passage.
- Not only a human-made canal.
- But a joint historical product of both.

According to modern scientific models, such systems are called “hybrid fluvial systems,” where:

- Natural channels.
- Climatic variability.
- Anthropogenic modification.

all simultaneously exert influence. Nara is a clear example of this, where the “state” of the system kept changing in every period.

7.3 Indus Civilization and Environmental Dependence (Environmental Determinism vs. Adaptation) From the Indus Civilization sites in the Nara Valley and surrounding areas, it is evident that:

- Settlement was closely tied to the presence of water.
- Expansion and contraction of settlements coincided with river dynamics.
- Urban planning took seasonal variability of water into account.

Two theoretical perspectives emerge here:

(a) **Environmental Determinism** Ancient societies were completely dependent on the environment.

(b) **Human Adaptation Model** Human societies adapted themselves to changes in water availability.

Current evidence partially supports both perspectives, but does not fully align with either one exclusively.

7.4 Reinterpretation of the Hakra–Nara Question
Building on the conclusions of Chapter Six, the Hakra–Nara question should no longer be seen as a binary (existence or non-existence), but rather as a spectrum:

- In some periods, extensive active flows.
- In some periods, limited seasonal channels.
- In some periods, complete dryness.

Therefore, instead of the “single river hypothesis,” the “episodic fluvial network hypothesis” appears stronger.

7.5 Integrated Reading of Satellite and Archaeology (Integrated Landscape Archaeology)
When remote sensing data is studied alongside archaeological site distribution, a clear pattern emerges:

- Settlement clusters are not linear but corridor-based.

- Ancient water routes served as axes of human habitation.
- There is correlation between abandoned channels and site abandonment.

This shows that the landscape itself functions as an “archaeological archive.”

7.6 Colonial Period as a Historical Interval (Colonial Hydrological Reconfiguration) During the British period, a major transformation occurred:

- Natural systems were converted into “managed systems.”
- Efforts were made to reduce seasonal variability.
- Water distribution was centralized.

This process was not only engineering, but also an epistemological change—meaning the very way of understanding nature was altered.

7.7 Scholarly Divergence In the Hakra–Nara–Saraswati debate, three major scholarly trends exist:

1. **Maximalist Interpretation** A large continuous river system existed.

2. **Minimalist Interpretation** Only localized channels and seasonal flows existed.
3. **Synthetic / Modern Geoarchaeological Model** A dynamic, shifting, multi-channel system existed.

Modern research largely leans toward the third model, because it integrates all datasets (archaeological + geological + satellite).

7.8 Overall Intellectual Conclusion The study of Nara is not merely the history of a river, but a broader intellectual question:

- How natural systems change.
- How human societies adapt to those changes.
- How historical landscapes are reconfigured over time.

In this sense, Nara holds importance as a “living geological archive,” which helps to understand Sindh’s civilizational and environmental history within a unified framework.

Conclusion: Integrated Research Model and Final Interpretation

Chapter Eight

8.1 Overall Conclusion The study of Nara makes it clear that this region does not represent a single simple historical or geographical reality. Rather, it is a complex system where:

- Natural river evolution.
- Climatic changes.
- Tectonic movements.
- Human engineering interventions.

all together created a long historical continuity. Therefore, describing Nara only as a “canal” or only as an “ancient river” would be a limited scholarly interpretation.

8.2 Final Scholarly Model (Integrated Interpretive Framework) On the basis of this research, an integrated model can be presented as follows:

1. Natural Fluvial Phase

- System of eastern distributaries of the Indus.
- Active channels with seasonal flows.
- Paleo-river formation.

2. Climatic Instability Phase

- Changes in monsoon variability.
- Reduction in water volume.
- Partial drying and fragmentation.

3. Abandonment Phase

- Decline of river flows.
- Drying of courses.
- Sediment deposition and burial of channels.

4. Anthropogenic Reuse Phase

- Revival of channels during the British period.
- Irrigation engineering.
- Water supply from Sukkur Barrage.

5. Modern Managed System

- Permanent irrigation.
- Regulated flow.
- Hybrid natural-artificial system.

8.3 Theoretical Significance This model presents three important scholarly conclusions:

1. River systems are not static, but dynamic.
2. Human history evolves together with environmental systems.
3. Systems like Nara are examples of “layered landscapes.”

8.4 New Interpretation of the Indus Civilization In the light of this study, the Indus Civilization should not be understood merely as a “river-based civilization,” but more appropriately as a: **“multi-channel hydrological civilization system.”**

That is:

- Not one river.
- But a civilization based on multiple interconnected water systems.

8.5 Recommendations for Future Research

- High-resolution LiDAR surveys.
- Deep sediment coring in the Nara basin.
- Isotope hydrology studies.
- Comparative GIS mapping with Cholistan and Thar.
- Interdisciplinary archaeology-hydrology models.

8.6 Final Intellectual Conclusion The essential scholarly lesson of Nara is that: History, land, and water are not separate, but different aspects of one continuous evolutionary process.

□ Research Model (Visual Interpretive Framework) This can be understood as the following conceptual structure:

[Monsoon Climate System] ↓ [Indus River Dynamics] ↓ [Eastern Distributary Network] ↓ [Palaeochannel Formation (Nara–Hakra Zone)] ↓ [Climatic Drying & Channel Fragmentation] ↓ [Archaeological Settlement Shifts] ↓ [Colonial Irrigation Engineering] ↓ [Modern Nara Canal System]

8.7 Final Note The study of Nara provides a key landscape for understanding Sindh's history, ecology, and civilizational evolution together. It demonstrates that human civilizations always evolve alongside natural systems, never apart from them.

Nara River: References

A. Foundational Works

1. Kenoyer, J. M. (1998). *Ancient cities of the Indus Valley Civilization*. Oxford University Press.
2. Possehl, G. L. (2002). *The Indus Civilization: A contemporary perspective*. AltaMira Press.
3. Wright, R. P. (2010). *The ancient Indus: Urbanism, economy, and society*. Cambridge University Press.
4. McIntosh, J. (2008). *The ancient Indus Valley: New perspectives*. ABC-CLIO.
5. Allchin, B., & Allchin, R. (1997). *The rise of civilization in India and Pakistan*. Cambridge University Press.
6. Mughal, M. R. (1997). *Ancient Cholistan: Archaeology and architecture*. Lahore: Ferozsons.
7. Lambrick, H. T. (1975). *Sind: A general introduction*. Jamshoro: Sindhi Adabi Board.
8. Dani, A. H. (1984). *Indus Civilization: New perspectives*. Islamabad: Quaid-i-Azam University Press.

B. Hakra–Saraswati and River System Studies

9. Giosan, L., et al. (2012). Fluvial landscapes of the Harappan civilization. *Proceedings of the National Academy of Sciences*, 109(26), E1688–E1694.
10. Clift, P. D., et al. (2012). U-Pb zircon dating evidence for a Pleistocene Sarasvati River. *Geology*, 40(3), 211–214.
11. Saini, H. S., Tandon, S. K., & Mujtaba, S. A. I. (2009). Reconstructing the paleochannel systems of the Ghaggar–Hakra. *Quaternary International*.
12. Singh, A., et al. (2017). Fluvial dynamics of the Ghaggar–Hakra system. *Quaternary Science Reviews*.
13. Staubwasser, M., & Weiss, H. (2006). Holocene climate and cultural evolution. *Science*, 313(5790), 707–710.
14. Valdiya, K. S. (2013). *Saraswati: The river that disappeared*. Hyderabad: Universities Press.
15. Danino, M. (2010). *The lost river: On the trail of the Sarasvati*. Penguin Books.

C. Archaeology of Cholistan, Thar, and the Indus Civilization

16. Mughal, M. R. (1982). Recent archaeological research in the Cholistan desert. *Journal of Asian Civilizations*.

17. Shaffer, J. G. (1992). The Indus Valley, Baluchistan and Helmand traditions. In *Chronologies in Old World Archaeology*.
18. Shaffer, J. G., & Lichtenstein, D. (1989). Early cultural development in the eastern Punjab. *World Archaeology*, 21(3), 331–351.
19. Kenoyer, J. M. (2005). Culture change during the Indus Civilization. *Asian Perspectives*, 44(2), 367–390.
20. Wright, R. P. (2008). Trade and interaction in the Indus Valley. *Journal of World Prehistory*, 21(2), 141–187.

D. Geoarchaeology and Hydrology

21. Schuldenrein, J. (2009). Landscapes and soils of the Upper Indus. *Journal of Archaeological Science*, 36(10), 2101–2110.
22. Courty, M. A. (1998). Geoarchaeology of river systems. *Geoarchaeology*, 13(4), 347–370.
23. Rajaguru, S. N. (2001). *Quaternary environments of India*. Memoirs of the Geological Society of India.
24. Sinha, R., et al. (2013). River avulsion and floodplain dynamics in the Indo-Gangetic basin. *Geomorphology*, 180–181, 52–64.
25. Madella, M., & Fuller, D. Q. (2006). Paleoenvironmental reconstruction of Indus

landscapes. *Vegetation History and Archaeobotany*, 15(4), 317–327.

E. Remote Sensing and Satellite Research

26. Farris, D. W., et al. (2009). Geoarchaeological mapping using remote sensing. *Remote Sensing of Environment*, 113(1), 55–65.
27. Panhwar, M. H. (1993). *The soils of Sindh and water history*. Sindh Archives.
28. Sindh Quarterly. (1993). The Hakra or Saraswati controversy. M. H. Panhwar Institute Publications.
29. NASA Earth Observatory. (Various years). Landsat imagery analysis of the Indus basin.
30. Indian Space Research Organisation (ISRO). (2010–2020). Satellite-based fluvial studies of northwestern India.

F. British Gazetteers and Official Reports

31. Aitken, E. H. (1907). *Gazetteer of the Province of Sindh*. Government of India.
32. Hughes, A. W. (1876). *Gazetteer of Sindh*. London: George Bell & Sons.
33. Burton, R. F. (1851). *Sindh and the races that inhabit the Valley of the Indus*. London: W. H. Allen.

34. Oldham, C. F. (1893). On the ancient river systems of north-west India. *Records of the Geological Survey of India*, 26, 139–151.
35. Oldham, R. D. (1886). On probable changes in the course of the Indus. *Memoirs of the Geological Survey of India*, 19, 1–34.
36. Survey of India Reports. (1870–1890). Eastern Nara irrigation documentation.

G. Modern Research Journals and Articles

37. Saini, H. S., Tandon, S. K., & Mujtaba, S. A. I. (2017). Holocene river dynamics in NW India. *Quaternary Science Reviews*, 166, 125–136.
38. Lawler, A. (2008). The Saraswati River debate revisited. *Science*, 319(5862), 40–41.
39. Petrie, C. A., et al. (2017). Settlement distribution and river systems in the Indus basin. *Antiquity*, 91(357), 389–410.
40. Weiss, H., et al. (2015). Climate change and collapse of early civilizations. *Proceedings of the National Academy of Sciences*, 112(30), 9216–9221.